

Chapter 3



Meghan Carfoll/USFWS

Tidal swamp forest view from Little Creek

Existing Environment

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3.1 Introduction

This chapter describes the current and historic physical, biological, and socioeconomic landscape and resources of Presquile NWR. We first describe the regional landscape, including its historical and contemporary influences, and then we describe the refuge and its resources.

3.2 The Physical Landscape

3.2.1 Watershed Context

The 1,329-acre refuge is part of the greater Chesapeake Bay watershed, a drainage basin of 64,000 square miles that encompasses parts of the States of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia. Waters from this expansive area flow into the Chesapeake Bay, the Nation's largest estuary. The watershed contains an array of habitat types including:

- Mixed hardwood forests, typical of the Appalachian Mountains
- Grasslands and agricultural fields
- Lakes, rivers, and streams
- Wetlands and shallow waters
- Open water in tidal rivers and the estuary

This diversity of habitat types in the watershed supports more than 2,700 plants and animal species, including Service trust resources such as endangered and threatened species, migratory birds, and migratory fish (USFWS 2011).

The James River is one of several major tributaries of the Chesapeake Bay watershed and is the geographic feature that defines the boundaries of Presquile NWR. The refuge is actually an island within the river. This river is formed by the confluence of the Jackson and Cowpasture Rivers and flows 340 miles from its headwaters in the mountains of Bath and Highland Counties, Virginia, to the Chesapeake Bay. While the entire James River watershed comprises about 6.5 million acres, the refuge occurs along its middle reaches at River Mile 80, upstream of the Chesapeake Bay.

3.2.2 Geologic Development

Presquile NWR lies within the Virginia Coastal Plain Physiographic Province of the Atlantic Coastal Plain, as delineated by U.S. Geological Survey (USGS). Physiographic provinces are broad-scale subdivisions based on terrain topography, rock type, and geologic structure and history. The Virginia Coastal Plain Physiographic Province consists of a series of terraces, or scarps, sloping downward toward the coast, with each terrace representing a former shoreline. It is the youngest physiographic province in the State and consists primarily of Holocene (11,700 years ago to present) and Pleistocene (2.6 million to 11,700 years ago) age sedimentary deposits of sand, clay, marl, and shell (USGS 1989). Its principle characteristics are a generally low topographic relief, extensive marshes, and tidally influenced rivers and creeks (USFWS 2007b).

The Virginia Coastal Plain Physiographic Province is separated on its western boundary from the Appalachian Piedmont Physiographic Province by the "Fall Line" which is a low, east-facing cliff that parallels the Atlantic coastline from New Jersey to the Carolinas. It separates hard Paleozoic (542 to 251 million years ago) metamorphic rocks of the Piedmont to the west from the softer, gently dipping Mesozoic (251 to 66 million years ago) and Tertiary (65 million to 2.6 million years ago) sedimentary rocks of the coastal plain. This erosional scarp, the site of many waterfalls, hosted flume- and water-wheel-powered industries in colonial times and helped determine the location of such major cities as Philadelphia, Baltimore, Washington, and Richmond. Richmond marks the approximate Fall Line on the James River (USFWS 2007b). The Virginia Natural Heritage Program (VNHP) further subdivides the coastal plain region into "northern," "southern," "inner," and "outer" Virginia coastal plain to account

for the rich variety and distinction of natural community types in the area. The refuge occurs within the southern coastal plain in the James River/Curles Creek subwatershed (JL 06) (VDEQ 2006).

3.3 The Cultural Landscape Setting and Land Use History

3.3.1 Early American Indian and European Influences

Known cultural resources from Presquile NWR date from the Late Archaic period (3,000 to 1,200 B.C.) through the 20th century. These resources contribute to further understanding of Virginia's history involving American Indian settlement and subsistence, initial exploration of the James River by Europeans beginning in 1607, plantation society, military history, and post-Civil War rural agriculture.

Three archaeological sites at Presquile NWR are known to contain American Indian components dating to the Late Archaic through Woodland periods (3,000 B.C. through European contact in 1607). The Archaic period is identified by archaeologists as the period when more localized seasonal settlement and subsistence patterns replaced the broad seasonal migration patterns of the earlier Paleo-Indian period (9,500 to 8,000 B.C.). In Virginia, the transition from nomadic to permanent, year-round settlement also increased dramatically during the Archaic period, as evidenced through the presence of stone bowls and small subsurface features (Goode et al. 2009). The innovation of ceramic technology and the emergence of cultivated plants generally identify the transition to the Woodland time period. In Virginia, the Woodland period is also characterized by the large-scale exploitation of shellfish, often visible archaeologically through the presence of mounds of discarded shells (Goode et al. 2009). Pre-contact sites at Presquile NWR have yielded artifacts including fire-cracked rock, projectile points, and blades. At least one of the sites exhibits repeat occupation over time (Goode et al. 2009). The archaeological evidence at Presquile NWR indicates a strong American Indian presence spanning thousands of years prior to European contact and continuing into the contact period.



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Archaeological survey conducted in 2010

Extensive American Indian settlements in the vicinity of Presquile NWR are well-documented in the colonial period. Historically, the Weyanock and the Appamattuck Tribes resided along the portion of the river near the current Presquile NWR (Goode et al. 2009). While the initial European colonization occurred at Jamestown Island on the James River in 1608, other settlements in the area soon followed. The English began expanding beyond Jamestown in 1609, taking by force the territories of the Kecoughtan, Paspahegh, Warraskoyack, Quiyoughcohannock, and Arrohateck Tribes (Goode et al. 2009). In 1613, acting governor Sir Thomas Dale seized the Appamattuck town, seat of Queen Oppussoquionuske, located at the confluence of the James and Appomattox Rivers. This town included present-day Presquile NWR.

Sir Thomas Dale established the Bermuda Hundred settlement and, by 1619, the population at Bermuda Hundred had risen to 119 people. By the middle 17th century, it had become a commercial center, serving as the primary inland port on the James River (Goode et al. 2009).

By the mid-1700s, Virginia was well-settled along the James River. Plantations were built to support tobacco production from the coast up to Richmond, Virginia. By 1751, a plantation was located on the peninsula near Bermuda Hundred, in the present day Presquile NWR (Goode et al. 2009). From 1785 to 1800, Bermuda Hundred was the official port of entry on the James River, boosting its waterfront development. Despite the loss of the customs house at the

turn of the century, Bermuda Hundred continued to be an important regional port well into the 19th century.

Due to its location near two major rivers, the land in and around Presquile NWR was an important site during the Civil War. In 1864, the Union Army landed at Bermuda Hundred with the intention of destroying the Confederate supply line between Richmond and Petersburg. Although the Union Army lost the subsequent battle upstream at Swift Creek, they maintained a presence at Bermuda Hundred until 1865 (Goode et al. 2009). While the main Union occupation was located several miles west of Presquile NWR, the wharves at Bermuda Hundred were extensively used by the Union Army. It is likely that the Watkins Farm, located within Presquile NWR, was either occupied or visited by Union troops (Goode et al. 2009). It is also likely that the Union Army guarded the James River shoreline along the current Presquile NWR because the Confederates controlled the opposite shore of the river (Goode et al. 2009). In addition, the Union used the land within Presquile NWR, then known as Turkey Bend, as a key observation point for river traffic coming south from Richmond, Virginia (Goode et al. 2009). Some local residents still refer to the island as Turkey Island, a name given by Captain Christopher Newport in the early 1600s.

After the Civil War, agriculture and timber production became the primary economies for the communities in and around Presquile NWR. In the 1880s, the Farmville, Powhatan, Tidewater, and Western Railroads were constructed, connecting the port at Bermuda Hundred to cities across Virginia (Goode et al. 2009). The rail line was eventually closed in 1917, due largely to the decline of coal mining, and the associated decline in freight. The demise of the railway system led to the slow and steady decline of Bermuda Hundred through the latter half of the 20th century (Goode et al. 2009).

For the majority of its history, Presquile NWR existed as a peninsula connected to the town of Bermuda Hundred. The James River formed an oxbow bend, encompassing approximately 6 miles (9.6 kilometer) of shoreline surrounding Presquile NWR. In an effort to reduce travel time for river traffic, the U.S. Army Corps of Engineers (USACE) cut a navigational channel through the peninsula in 1934. This cut, the Turkey Island Cutoff, made Presquile NWR a true island (USFWS 2004a).

3.3.2 Historic Occupation of Presquile NWR over the Past 300 Years

During the mid-17th century, land outside the village of Bermuda Hundred was held in small and medium-sized plantations (Goode et al. 2009). William Randolph, ancestor to prominent Virginians, such as Thomas Jefferson, John Marshall, and Robert E. Lee, purchased the Presquile peninsula (present-day Presquile NWR) around 1660, although his family plantation was located on the north side of the river and not within the current refuge boundaries (Goode et al. 2009). David Meade Randolph, great-great grandson of William Randolph, lived on Presquile NWR by 1790. He is the first documented occupant of a house located within the refuge that was demolished in 1965 (Goode et al. 2009). The Presquile property was sold by the Randolph family in 1801, and successive ownership changed hands through four different families between 1801 and 1902 when it was purchased by Mr. A.D. Williams (Goode et al. 2009).

Mr. Williams maintained a dairy farm and country estate on the island, with at least 5 separate houses and over 30 farm and estate-related structures. In his will, Mr. Williams bequeathed 1,329 acres of lands and waters to the U.S. Department of the Interior for the purpose of “the preservation, protection, replenishment, and propagation of and for increasing the supply of game birds, game animals, fish and other wildlife in the State of Virginia.” The Service determined that the property was of sufficient importance to warrant administration as a national wildlife refuge and established Presquile NWR on March 7, 1953.

The Service used the much-modified, 18th-century Randolph family house as a staff residence until it was demolished in 1965. Although the house was destroyed and other associated outbuildings no longer exist, the historic plantation locality is listed as an archaeological and architectural site by the Virginia Department of Historic Resources. Portions of the



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Gravestone at the Presquile Cemetery

main house foundations are visible today and it is probable that the foundations of various outbuildings remain, in addition to associated archaeological resources (Goode et al. 2009).

3.4 Current Climate and Potential Effects of Climate Change

3.4.1 General Climate Description

The climate of the middle James River system is humid subtropical as determined by latitude, topography, prevailing westerly winds, and the influence of the Atlantic Ocean. Prevailing winds are westerly with highest wind speeds in the spring (USFWS 2007b). Average annual temperature fluctuations typically range from a high of approximately 71 °F to a low of approximately 48 °F. The average monthly temperature ranges from 37 °F in January to 48 °F in July. Precipitation averages 44 inches annually, with peak rainfall occurring in the summer (see table 3.1). Local annual average relative humidity is 68 percent. Prevailing winds in the spring and summer are from the south-southeast, while those in the fall and winter are from the north-northwest. Local average annual wind speed is 4 miles per hour (<http://www.wunderground.com/history/airport/KPTB>; accessed May 2012). Data available for Hopewell, Virginia (Station 444101) indicates the growing season to be approximately 185 days, and the average annual snowfall is 7.9 inches (SERCC 2012).

Table 3.1. Monthly Average Temperature and Precipitation for the Refuge Vicinity

Month	Average Temperature (in degrees Fahrenheit)	Average Precipitation (in inches)
January	37	1.65
February	48	1.01
March	53	11.40
April	65	1.49
May	72	4.79
June	83	1.89

Month	Average Temperature (in degrees Fahrenheit)	Average Precipitation (in inches)
July	84	2.13
August	81	5.79
September	77	6.96
October	64	4.01
November	52	1.32
December	35	5.22
Annual average/total	63 (annual average)	47.66 (annual total)

3.4.2 Global Climate Change

Global climate change is a significant concern to the Service and to its partners in the conservation community. Tidal marshes are among the most susceptible ecosystems to climate change, especially accelerated sea level rise. The International Panel on Climate Change (IPCC) Special Report on Emissions Scenarios suggested that global sea level would increase by approximately 12 to 40 inches (30 to 100 centimeters) by 2100. Other scientists suggest that this range may be too conservative and that a more likely range could be 20 to 80 inches (50 to 200 centimeters) by 2100 (Clough et al. 2009). Spring and summer temperatures will rise with earlier spring snowmelt, wildfires will increase in number and be larger and of longer duration, and tropical storms will increase in frequency and intensity (Scott et al. 2008).

3.5 Air Quality

The EPA collects emissions data on three common air pollutants that can negatively impact human health and the environment: carbon monoxide, sulfur dioxide, and particulate matter. The EPA also collects data on three major promoters of these air pollutants: volatile organic compounds, nitrogen oxides, and ammonia. These data are summarized in the Air Quality System database, EPA's repository of criteria air pollutant monitoring data. This database reports the number of days when air quality was good, moderate, or unhealthy for sensitive groups, by station county (counties with air quality monitoring stations). Table 3.2 presents the air quality data for the counties near Presquile NWR.

Table 3.2. Air Quality Data from the EPA's Air Quality System Database for Three Counties near Presquile NWR, 2006.

County	Percentage of Days in 2006 when Air Quality was Good, Moderate, or Unhealthy		
	Good	Moderate	Unhealthy for Sensitive Groups
Charles City County	84 percent	15 percent	Less than 1 percent
Chesterfield County	81 percent	18 percent	Less than 1 percent
Henrico County	65 percent	34 percent	1 percent

Source: www.epa.gov/airdata (accessed May 2012).

VDEQ monitors levels of ozone and particle pollution from several stations in Virginia. The Air Quality Index is a measurement of air quality that is calculated from measurements of these pollutants over several hours. A higher rating indicates a higher level of air pollution and consequently, a greater potential for health risk. According to VDEQ's Division of Air Program Coordination,

Chesterfield County lies within an ozone maintenance and emission control area for oxides of nitrogen and volatile organic compounds.

Presquile NWR is located in the Richmond-Petersburg Metropolitan Statistical Area (<http://www.epa.gov/ozonedenignations/2008standards/rec/region3R.htm>; accessed May 2012). Air quality in the Richmond-Petersburg Metropolitan Statistical Area was good for the majority of days during 2010 (EPA 2011a). There are two air quality monitoring stations within a 5-mile radius of Presquile NWR (EPA 2011b). One station is located 0.43 miles east of Presquile NWR at the Shirley Plantation (Site 51-036-0002). The other station is located approximately 4 miles south of Presquile NWR, at 1000 Winston Churchill Drive in Hopewell (Site 51-670-0010). Sulfur dioxide, nitrogen dioxide, particulate matter (0 to 2.5 micrometers), and ozone are currently being monitored at Shirley Plantation; particulate matter (0 to 10 micrometers) is currently monitored at the Hopewell site. Ground-level ozone exceeded the air quality standard on 4 days in 2012 (July 6, 7, 15 and September 23; range: 78 to 84 parts per million (ppm)).

The city of Hopewell, Virginia, is heavily industrialized. Four industrial plants are within 1 mile of Presquile NWR. Occasionally, when wind and other factors are unfavorable, haze and odor from these plants are quite evident (USFWS 2004a). VDEQ collected data on the long-term cancer and non-cancer risk exposure to the air quality in the Hopewell area using three monitoring stations for 3 years (McMurray and Anthony 2010). All three sites exceeded the benchmark estimated risk probability, which is the chance that a person living near a source would have health risks if exposed to a maximum pollutant concentration for 70 years (EPA 1989). The most important carcinogenic chemicals detected were carbon tetrachloride and formaldehyde. A suite of non-carcinogenic chemicals were also measured to determine the risk that a person living near the area would develop some negative effect to their health due to exposure to these chemical concentrations. All three sites had a risk level that exceeded the probability of a person developing non-carcinogenic health effects; however, when compared to the rest of the State of Virginia, the Hopewell area is very similar to other urban areas. The non-carcinogenic compound of greatest concern is acrolein.

Real-time air quality information for the sites in the refuge vicinity are available on VDEQ's Web site at: http://vadeq.ipsmtx.com/cgi-bin/aqi_map.pl?metro01_aqi.png (accessed May 2012).

3.6 Hydrology and Water Quality

3.6.1 Summary of the General Condition of the James River Basin

The entire James River Basin covers 10,265 square miles or approximately 24 percent of Virginia's total area. The James River Basin is the largest of Virginia's Chesapeake Bay watersheds. The James River Basin is divided into eight USGS hydrologic units (HUCs) as follows: Upper James, Maury, Upper Middle James, Rivanna, Lower Middle James, Lower James, Appomattox, and Elizabeth. The 8 HUCs are further divided into 109 waterbodies and 298 sixth-order subwatersheds. Presquile NWR is located within the Lower James River HUC. The largest tributary to the James River near the refuge is the Appomattox River, approximately 2.5 miles to the south (VDEQ 2010).

The Fall Zone is a 3-mile stretch of river running through Richmond where the river descends 84 feet as it flows from the Piedmont Physiographic Province to the Coastal Plain Physiographic Province (VDEQ 2010). The tidal influence extends to the Fall Line east of Richmond and up many of the creeks in the Lower James River HUC. Formerly, there were five dams along the James River in the Richmond area, but no dams remain there or elsewhere further downstream. However, significant remnants or partial dams remain at locations in the Fall Zone.

Cyrus Brame/USFWS



Ferrying trees out to the refuge to be planted.

More than 65 percent of the James River Basin is forested, while 19 percent is cropland and pasture. Approximately 12 percent is considered urban. In 2006, the population of the James River Basin was approximately 2,092,278. This population was concentrated in two metropolitan areas: Tidewater, with over 1 million people, and the Greater Richmond-Petersburg area with over 650,000 (VDEQ 2010).

According to the James River Association's (JRA) State of the James River 2009 report, the overall river health score for the James River has increased 1 percent since 2007; however, troubling signs indicate the need to strengthen river restoration efforts. Three of the critical habitats—underwater grasses, riparian forests, and tidal water—included in the report have improved in recent years. Some of this is due to reduced pollution levels entering the river in recent years that have

helped improve water quality and habitat conditions. However, some of the reduced pollution levels are attributed to lower rainfall in recent years resulting in less polluted runoff. When the true effectiveness of pollution control efforts is measured, removing the influence of annual weather variations, progress in reducing harmful pollutants to the James River has stagnated and in some cases reversed. Long-term, adjusted average of pollution discharges to the James River has leveled off from significant improvements achieved early in the river cleanup effort. In addition, the slowing of actual pollution controls, despite increased investment in wastewater and agricultural programs, shows that other sources of pollution, such as new and existing development, must be addressed. Currently, 61 percent of the James River's streams are categorized as being in good or excellent condition. However, many streams are still under moderate to severe stress. The tidal James River continues to have problems with excessive algae growth and water clarity remains very poor, meeting the State standard only 6 percent of the time. The most pervasive forms of pollution in the James River are sediments, phosphorus, nitrogen, and bacteria (JRA 2009).

3.6.2 Influences on Ground and Surface Water Quality

Near-surface sources of contamination have the potential to impact water supplies in the upper 100 feet of the coastal plain's shallow regional aquifer, the aquifer from which drinking water is withdrawn for refuge operations (http://pubs.usgs.gov/wri/wri03/4278/wrir03_4278.pdf; accessed May 2012).

Chemical Pollution

Ten EPA Superfund sites are located in the Lower James River watershed, including five private sites and five Federal facilities. In addition, four EPA facilities of interest are located on Bermuda Hundred across the James River from Presquile NWR. The facilities report identifies records of environmental interests, Standard Industrial Classification Codes, National Industry Classification System Codes, and basic information (address, ownership, contacts, etc.) (<http://www.epa.gov/enviro/html/fii/ez.html>; accessed May 2012).

Four superfund sites are currently listed within the four-county area surrounding Presquile NWR, although none of the sites are near the refuge. Tributaries to the James River that may have had discharges of chemicals or contaminants include North Run Creek and No Name Creek.

Lastly, there are four Resource Conservation and Recovery Act sites (solid and hazardous wastes sites) in the general vicinity of the refuge: three in the city of Hopewell and one approximately 0.9 mile southwest of the refuge on Bermuda Hundred Road. None of these sites appear to pose a threat to waters surrounding or within the refuge.

No voluntary remediation program sites are known to occur within 3 miles of Presquile NWR (VDEQ 2012a, VDEQ 2012b).

Sediments

Erosion from upland land surfaces and erosion of stream corridors (banks and channels) are the two most important sources of sediment coming from the James River watershed. Although erosion is a natural process, it may have increased significantly over the past few centuries because of human impact. Major sources of sedimentation and erosion include barren construction sites and plowed farm fields. In addition, impervious surfaces increase the volume and velocity of stormwater runoff causing stream bank erosion. For the entire Chesapeake Bay region, river basins with the highest percentage of agricultural land use have the highest annual sediment yields, and basins with the highest percentage of forest cover have the lowest annual sediment yields. Urbanization and development can more than double the natural background sediment yield, with the highest increase in sediment yield occurring during early development stages (USFWS 2007b).

During the 18th and 19th centuries, nearly 70 to 80 percent of the original forest cover was cleared, which increased erosion rates in the watershed. Although reforestation followed 20th century farm abandonment, high erosion rates continue. This may be attributed to development and remobilization of deposits of previously eroded material. Furthermore, much of the sediment eroded from cleared land during colonial times may still be stored in upland areas, stream corridors, channels, and tributaries. The proportion of this stored sediment that has actually reached Chesapeake Bay is unknown, but this “legacy” sediment will ultimately make its way to the bay. Such large quantities of stored sediment means that future improvements in water clarity may take years to decades following implementation of land-use changes in the watershed. A 2003 USGS report describes the relative concentrations of total suspended solids in Chesapeake Bay and tributaries to the bay (USGS 2003). Watershedwide, the nonpoint source reductions call for best management practices to be installed and maintained on 92 percent of all available agricultural lands, 85 percent of all mixed open lands, and 74 percent on all urban lands. According to VDEQ, the best management practices for reducing nonpoint source pollution are to refocus available tools, steer new resources to Virginia’s strongest nonpoint source control programs, and push them to maximize reductions across the landscape (VDEQ 2010b).

3.6.3 Long-term Trends and Status of Surface Water Quality for the James River (2003 to 2010)

A recent water quality summary of the Chesapeake Bay and its tributaries by VDEQ (2010) describes the trends and status of water quality and living resource conditions from January 1, 2003, through December 31, 2008. More detailed information is also available on VDEQ’s Web site at: <http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring.aspx> (accessed June 2012). VDEQ monitored 38 fixed stations on the Rappahannock, York, and James Rivers. State water quality standards define the water quality needed to support each of the six designated uses for surface waters in Virginia: aquatic life, fish consumption, public water supplies, recreation, shellfishing, and wildlife. If a waterbody contains more pollutants than allowed by the water quality standards, it will not support one or more of its designated uses. Such waters are considered to have “impaired” water quality.

VDEQ’s Quality Assurance Project Plan describes field sampling procedures for water quality between July 1, 2009, and June 30, 2010. This plan conducted water quality sampling at 32 stations within the mainstem Chesapeake Bay and the Elizabeth River. Parameters sampled at each station include temperature, pH, salinity, specific conductance, dissolved oxygen silicate (filtered), particulate carbon, total suspended solids, fixed suspended solids, chlorophyll a and phaeophytin (report at all wavelengths), particulate nitrogen and total dissolved

nitrogen, nitrate and ammonia (filtered), particulate phosphorus, total dissolved phosphorus, dissolved orthophosphate, and dissolved organic carbon-surface samples. In addition, phytoplankton, picoplankton, and primary productivity samples are collected at each station.

The abiotic measures used for water quality included total suspended solids, nitrogen and phosphorus load, chlorophyll a, temperature, salinity, and dissolved oxygen. The biotic parameters of quality included the phytoplankton community (floating organisms that can do photosynthesis for energy); the benthic community (organisms that dwell or feed on the bottom—the benthic index of biotic integrity is used to measure overall quality and identification of impaired waters); abundance/biomass ratios as a measure of pollution due to organic enrichment; and submerged aquatic vegetation. USGS sampling stations were placed above the Fall Line along the James River in Cartersville and above the Fall Line along the Appomattox River about 2.5 miles south of Presquile NWR. Living resource monitoring stations were placed along the James River downstream of the Fall Line, with a complete monitoring station placed in a tidal freshwater zone near Hopewell (TF5.5) some 3 miles south (downstream) of the refuge, and a plankton monitoring station at the mouth of the James River (LE5.5). The zone of most relevance to Presquile NWR is the tidal freshwater zone (VDEQ 2005).

Based on estimates provided by VDEQ, total point and nonpoint source loadings of nitrogen to the James River are approximately 17,103,000 kilograms per year with nonpoint loadings accounting for nearly 57 percent. Application of best management practices are estimated to have resulted in a 9 percent reduction of nonpoint source loadings and a 31 percent reduction in point source loadings of total nitrogen from 1985 to 2004. Total point and nonpoint source loadings of phosphorus were approximately 2,251,000 kilograms per year in 2004 with nonpoint sources accounting for almost 70 percent of the total load. From 1985 through 2004, best management practices reduced nonpoint source loads by an estimated 15 percent while point source loads dropped by 61 percent, probably as a result of the phosphate ban. Approximately 1,014,000 metric tons per year of sediment enter the tidal James River due to nonpoint source runoff. As stated previously, application of best management practices resulted in a 12 percent reduction in sediments from 1985 to 2004 (VDEQ 2005).

Although phytoplankton composition in the James River is represented by favorable dominance and abundance levels of diatoms, chlorophytes, and cryptophytes, there are significant signs of degradation. Status of most phytoplankton metrics was either poor or fair in the James River while status of primary productivity was poor at station TF5.5 near Hopewell and fair at station LE5.5 in the James River Mouth segment (VDEQ 2005).

The benthic community met water quality goals at most stations in the main stem of the James River except station LE 5.2 in the Lower James River (near mouth of the Pagan River) and at station TF 5.5 (near Hopewell, downstream of the refuge) (VDEQ 2005).

The widespread distribution of the water clarity problems in the James River makes identification of its sources difficult. Water clarity can be related to sediment loadings from nonpoint source runoff, shoreline erosion or marsh erosion, phytoplankton densities, sediment re-suspension, concentrations of dissolved organic matter, or a combination of these factors. Each of these factors could be influenced directly or indirectly by point and nonpoint source runoff of nutrients or sediments. Additional best management practices for erosion control could help to reduce sediment loadings to the James River while reductions in point source nutrients could help to reduce phytoplankton concentrations in the James River (VDEQ 2005).

Although the region experienced a dry period from 1999 through 2002, there were no significant long-term trends in freshwater flow in either the James River or Appomattox River (VDEQ 2005).

3.6.4 State-Impaired Waters in the James River from VDEQ Report Impaired Waters (2010)

In November 2010, VDEQ released the 305(b)/303(d) Water Quality Assessment Integrated Reports. These reports provide a summary of the water quality conditions in Virginia from January 1, 2003, through December 31, 2008. The report combines both the 305(b) Water Quality Assessment and the 303(d) Report on Impaired Waters for each river basin. These reports are compiled by the VDEQ with the assistance of the Virginia Department of Conservation and Recreation (VDCR), and are submitted to EPA and Congress to satisfy the Federal reporting requirements under Section 305(b) of the Clean Water Act and the Virginia Water Quality Monitoring, Information and Restoration Act § 62.1-44 19:4 through 62.1-44-19.8 of the Code of Virginia.

The report on impaired waters in the State describes segments of streams, lakes, and estuaries that violate water quality standards and details the pollutant responsible for these violations, as well as the cause and source of the pollutant, if known. Most impairments to water quality in the James River watershed come from *Escherichia coli* (*E. coli*), which is primarily related to agriculture practices, but is also a result of urban runoff, leaking sanitary sewers, urban storm sewers, and failing septic tanks. Domestic animals and wildlife can also be significant contributing sources (VDEQ 2010).

Within the entire James River Basin (i.e., the main stem and tributaries), the impairment by designated use has been determined by the VDEQ, and is summarized in table 3.3. Parameters or designated uses of impairment that were assessed within the watershed include aquatic life, fish consumption, public water supply, recreation, and wildlife and are expressed in “river miles” (VDEQ 2010). The EPA-approved total maximum daily load document for James River, Turkey Island Creek, and Fourmile Creek listed impairment for *E. coli* (VDEQ 2010, EPA 2010).

Table 3.3. James River Basin Impairment by Designated Use

	Number of River Miles in James River Basin				
	Aquatic Life	Fish Consumption	Public Water Supply	Recreation	Wildlife
Total Number of River Miles Assessed	4,078	1,960	257	3,293	3,395
Number of River Miles that Fully Supported the Designated Use	3,177	1,698	257	1,517	3,389
Number of River Miles that have Total Impairment for the Designated Use	902	262	0	1,776	6
Number of River Miles that have a Naturally Impairment for the Designated Use	148	0	0	0	0
Number of River Miles that had Insufficient Data	226	43	0	166	0

3.6.5 Submerged Aquatic Vegetation as an Indicator of Water Quality

Submerged aquatic vegetation (SAV) is a critically important component of the aquatic environment in the Chesapeake Bay, and its presence and healthiness are indicators of good water quality. SAV is important in marine environments because it serves as a major food source for wildlife, provides refuge for juvenile crabs and fish, stabilizes sediments preventing shoreline erosion and excessive suspended materials in the water column, and produces oxygen in the water column. SAV can only thrive in shallow depths where light reaches the benthic zone (i.e., bottom of the waterbody). The rooted aquatic beds provide shelter and food for numerous aquatic invertebrates, and blue crabs need their protective cover during their molt. A great number of waterfowl and aquatic mammals (e.g., muskrats) feed on SAV (USFWS 2007b).

SAV acreage has reached its highest levels in 30 years and now covers 40 percent of the goal set for the James River by the State. However, while underwater grasses are thriving in many of the tidal tributaries to the James River, as well as above the falls, there are still no underwater grass beds anywhere on the mainstem of the James River from Richmond to the James River Bridge in Newport News due to poor water clarity (JRA 2009). Interactive mapping for current and historical SAV monitoring illustrates that the James River adjacent to Presquile NWR has not supported SAV at any time between the first monitoring on record in 1971 through the 2009 monitoring (VIMS 2011).

A survey of water quality and living resource conditions in Mid-Atlantic estuaries indicated that the SAV habitat requirements were not met in 68 percent of the tidal portion of the James River (VDEQ 2005). SAV habitat requirements for nutrients, where applicable, were either borderline or not met with the exception of surface dissolved inorganic phosphorus in the Chickahominy River. Surface chlorophyll passed the SAV habitat criterion in all segments except the Appomattox River where it was borderline. Surface total suspended solids status was either borderline or failed to meet the SAV requirement in all segments except the James River segment downstream of the refuge and the mouth of the James River, where the criterion was met. Secchi depth either failed to meet the SAV habitat requirement or was borderline in all segments (VDEQ 2005).

The Chesapeake Bay Program committee established a goal to restore 3,483 acres of SAV within the James River Basin portion of the Chesapeake Bay watershed. Of this amount, 1,600 acres are proposed for restoration within the Upper James River watershed, which includes the vicinity of Presquile NWR (Murphy 2003).

3.6.6 General Water Quality Conditions in the Vicinity of Presquile NWR

Tidal waters of the James River, with average daily amplitudes of 3 feet, surround Presquile NWR. Rain, wind, or full moon tides can cause the river to fluctuate several feet from normal. In the area of the refuge, the James River is slightly brackish, with salinities ranging from a high of about 25 ppm in the summer to a low of 10 ppm in the winter (USFWS 2004a).

View of the James River



Site-specific water quality information has been provided by JRA (Frederickson personal communication 2007). JRA recorded data on dissolved oxygen and pH levels at the entrance to the Turkey Island Cutoff for the period May 9, 2006, through October 3, 2007. Dissolved oxygen levels ranged from a low of 4.5 ppm to a high of 13 ppm, with an average of 8.6 ppm. When oxygen levels drop below 4 ppm, aquatic life is put under stress. Oxygen depletion is a major source of fish kills. The pH levels ranged from a low of 7.2 to a high of 8.7, with an average of 7.7.

One groundwater well is located in the public use area at Presquile NWR. Refuge facilities supply water to kitchen sinks, as well as restroom sinks, toilets, and showers in the environmental education center. An October 2011 investigation was conducted to determine the construction and integrity of the well, test the capacity of the well and pumping equipment, and collect a series of water samples to determine if the water is potable (i.e., safe for drinking). The well casing showed no signs of failure or surface water infiltration. Water sample tests determined that the well water is suitable for a domestic drinking supply by EPA standards.

Following this investigation, maintenance of the well was completed during March to April 2012 to clean the well casing, replace the failed bladder tank, install a weatherproof, insulated cover on the well head and equipment, and install sediment and carbon filters to contain sand and improve taste. The Service requires that wells be tested for total bacteria quarterly and for nitrates, nitrites, lead, and copper annually (Guiel personal communication 2011).

3.7 Noise and Soundscapes

Noise has the potential to impact wildlife populations and the human experience on the refuge. The landscape surrounding Presquile NWR is comprised of the Curles Neck area to the west, which is a complex of existing marsh, managed ponds, and agriculture. Currently this area is being managed as a private hunt club. Agriculture and forestry make up the northern to southeastern portions of the adjacent lands. Industry is adjacent to the refuge across the James River along the southwestern border. The island setting of the refuge results in no roads intersecting the refuge. The nearest road, New Market Road, is approximately 0.6 miles to the north. I-295, the nearest interstate, is approximately 3.7 miles to the west of the refuge while State Highway 10, another heavily traveled road, is approximately 2.8 miles to the south. The James River is used for recreational boating and barge traffic carrying materials up and down the river.

The major human activities that contribute to the soundscape of Presquile NWR include boat traffic (both recreational and barges), industry to the southwest, hunting in the areas adjacent to the refuge boundaries during the waterfowl season in the fall, and refuge visitors. In all likelihood, these human activities have minimal impact to wildlife resources of Presquile NWR because of the island's physical isolation from large or continuous noise impacts. Also, overall, the lack of major sound disturbance on the refuge creates a naturalistic soundscape.

Species that occupy the interior of the refuge are likely buffered from any human sound sources that would have a negative impact on their lifecycle. The refuge has a limited trail system, which helps to minimize disturbance from visitors on the refuge. We will consider the impacts of sounds on wildlife when planning any changes to refuge management or additional recreational activities that increase access to the refuge's interior.

3.8 Socioeconomic Landscape

3.8.1 Regional Socioeconomic Setting

Regional Demographics

According to the U.S. Census Bureau, Presquile NWR is located in the Richmond, Virginia, Metropolitan Statistical Area. This area includes Chesterfield County, Prince George County, and the cities of Hopewell, Petersburg, and Richmond. The city of Hopewell is located south of the refuge, while the city of Richmond (the largest in Virginia) is located to the northwest. Tables 3.4 and 3.5 describe the general regional demographics.



Earth Day

Table 3.4. Regional Population Demographics, 2010.

	Population	Population Density (people per square mile)	Median Age	Population Change Between 2000 and 2010
State of Virginia	8,001,024	203	37.5	+ 13.0 percent
City of Richmond	204,214	3,404	31.3	+ 3.2 percent
City of Hopewell	22,591	2,259	36.5	+ 1.1 percent
Chesterfield County	316,236	748	37.6	+ 21.7 percent
Charles City County	7,256	40	46.6	+ 4.8 percent
Henrico County	306,935	1,257	37.5	+ 17.0 percent

(U.S. Census Bureau 2012; Henrico County 2012)

In creating table 3.5, we used the following definitions:

- Minority population includes persons who identified themselves and members in their households as members of the following groups:
 - ✱ One Race: American Indian and Alaska Native; Asian; Black or African American; Hispanic; Native Hawaiian and Other Pacific Islander; White; or some other race.
 - ✱ Two or More Races: Any combination of two or more of these race categories.
- Low-income population includes persons living below the poverty line.
- Linguistically isolated population includes persons who speak English less than “very well.”

Table 3.5. Regional Racial, Economic, and Linguistic Demographics, 2010.

	Majority Race Population	Minority Population ¹	Low-income Population ²	Linguistically Isolated Population ³
State of Virginia	White 70.4 percent	29.6 percent	10.3 ± 0.2 percent	2.7 ± 0.1 percent
City of Richmond	White 76.2 percent	23.8 percent	13.8 ± 0.1 percent	4.7 ± 0.1 percent
City of Hopewell⁴	White 55.4 percent	44.6 percent	20.4 ± 2.9 percent	1.3 ± 1.0 percent
Chesterfield County	White 68.3 percent	31.7 percent	5.9 ± 0.6 percent	2.2 ± 0.2 percent
Charles City County	Black or African-American 48.4 percent	51.6 percent	9.7 ± 2.6 percent	0.0 ± 1.4 percent
Henrico County	White 59.2 percent	40.8 percent	9.6 ± 0.7 percent	2.9 ± 0.4 percent

¹ Minority population includes all races except the majority race, based on total population. Data source is the “QT-P4 Race, Combinations of Two Races, and Not Hispanic or Latino: 2010” tables (USCB 2010).

² Low-income population based on the percentage (and percent margin of error) of people whose income in the past 12 months is below the poverty level. Data source is the “DP03 Selected Economic Characteristics: 2008-2010 American Community Survey 5-Year Estimate” tables (USCB 2010).

³ Linguistically isolated population based on the percentage (and percent margin of error) of households. Data source is the “S1602 2005-2009 American Community Survey 5-Year Estimates” tables (USCB 2010).

⁴ Nearest incorporated city to Presquile NWR, not within any adjacent County.

Land Use

Land use surrounding Presquile NWR currently includes industrial lands to the south and southwest in Chesterfield County; largely agricultural and forested lands to the east in Charles City County; and residential (single family, single family acreage and assisted living), commercial, light industrial, open space-recreation, public, semi-public, public service corporation and vacant to the north in Henrico County. Future land use projected for Chesterfield County southwest of the refuge retains industrial lands but also includes a proposed “Bermuda Hundred Park” to the west along the James River and another smaller park to the south along the river (<http://www.co.chesterfield.va.us/>; accessed May 2012). Within Charles City County to the east, lands are proposed as conservation areas (<http://co.charles-city.va.us/>; accessed May 2012), while in Henrico County, lands to the west and north are projected to remain environmental protection areas, open space/recreation, prime agriculture, rural residential, suburban residential 1, office, office/service, commercial concentration, government, and semi-public (<http://www.co.henrico.va.us/planning/>; accessed September 2012). It should be noted that future land use projections are subject to change over time.

Employment

Virginia’s well-developed transportation system and central location along the Atlantic Coast provide access to major markets throughout the U.S. Nearly 50 percent of the Nation’s population and 50 percent of the manufacturing activity are within 500 miles of Richmond, the State capital. The Richmond Metropolitan Statistical Area is a leading manufacturing, finance, trade, and corporate headquarters center in Virginia (VEDP 2008).

In 2005, Forbes Magazine ranked the Richmond area as one of the best places for business and careers in the U.S., primarily due to its highly educated labor force and relatively low business codes. Other areas of the economy

that have developed recently include pharmaceuticals, insurance, advertising, biotechnology, education, tourism, health services, and semi-conductors. In 2009, travel and tourism was the fifth largest industry by nonfarm employment in Virginia, with travelers spending \$17.7 billion (VATC 2010). Visitor centers that promote local tourism occur in Henrico County and in the cities of Richmond, Petersburg, and Hopewell.

Chesterfield County is a developing urban and suburban county that includes the southeast metro Richmond area. The largest employment category in Chesterfield County is retail trade, while healthcare and social assistance and education services rank second and third, respectively. Large manufacturing industries include plants of E.I. du Pont de Nemours & Company, Honeywell, Inc., and Alstom Power, Inc. (<http://www.chesterfieldbusiness.com>; accessed May 2012). Commercial farming is a secondary economic factor in the county. The chief crops are forage (e.g., hay), soybeans, poultry, and nursery/floriculture/sod (<http://www.nass.usda.gov>; accessed May 2012).

Forest industry was once a major landowner in the county and much of the planted pine acreage is due to that fact. However, many acres of former forest industry lands have been sold to developers, investment companies, and private individuals. The majority of timber harvested in the county as in the rest of the U.S. comes from private landowners. Even though Chesterfield County is rapidly developing, many landowners still actively manage their forest resource especially in the southern and western portions of the county. Chesterfield's forests provide raw materials to Virginia's Forest Products Industry which is still the largest manufacturing industry in the Commonwealth. Between 1986 and 2006, approximately \$56,872,938 worth of timber was harvested in Chesterfield County. The average amount harvested during those 21 years was \$2,708,235 per year. The highest amount harvested was \$6,334,124 in 2000 (VDOT 2010). Table 3.6 describes the major employment sectors in communities near the refuge.

Table 3.6. Percentage of Civilian Workforce Over 16 Years or Older by Industry, 2010.

	City of Richmond	City of Hopewell	Chesterfield County	Charles City County	Henrico County
Agriculture, forestry, fishing and hunting, and mining	0.1	0.3	0.3	2.7	0.0
Construction	5.1	7.7	6.6	9.8	4.6
Manufacturing	9.0	9.9	8.6	16.7	6.8
Wholesale Trade	1.9	1.2	3.0	2.8	2.9
Retail Trade	10.7	14.8	12.2	12.0	11.5
Transportation, warehousing, and utilities	4.0	5.5	4.7	6.9	4.1
Information	1.9	0.7	1.5	0.6	1.4
Finance, insurance, real estate, leasing, and rental	8.9	4.1	10.0	4.3	14.9
Professional, scientific, management, administrative, and waste management services	13.4	10.7	10.6	10.4	14.3

	City of Richmond	City of Hopewell	Chesterfield County	Charles City County	Henrico County
Educational services, health care, and social assistance	22.7	23.6	22.9	16.1	20.5
Arts, entertainment, recreation, accommodation, and food services	11.3	10.4	5.9	6.5	8.5
Public administration	6.3	6.2	9.0	6.7	6.3
Other services	4.6	4.9	4.6	4.6	4.0

(U.S. Census Bureau 2012)

3.8.2 Refuge Contributions to the Local Economies

Recreational visitors to the refuge can impact local income and employment. According to the 2007 “Banking on Nature” report compiled by Service economists, the Refuge System is a major economic engine for local communities (Carver and Caudill 2007). A study conducted in 2007 based on data from the 2006 Refuge Annual Performance Plan, indicates that visitation numbers at Presquile NWR have been growing at an average rate of about 20 percent per year since 2003. In general, approximately 80 percent of visitors to Presquile NWR live within a 30-mile radius of the refuge. In 2006, total visitor recreation expenditures at Presquile NWR were \$12,300, of which 62 percent represented non-residents (Carver and Caudill 2007).

Presquile NWR further contributes to the regional economy through direct expenditures and refuge revenue sharing payments to Chesterfield County. Direct operational expenditures include those made for supplies, services, and utilities required for the refuge, and are designated within a 50-mile radius of the refuge. The Federal government does not pay property taxes on purchased refuge lands, instead, the Revenue Sharing Act (16 U.S.C.715s) requires that the revenue sharing payments to counties for our purchased land will be based on the greatest of (a) three-quarters of 1 percent of the market value, (b) 25 percent of the net receipts, or (c) 75 cents per acre (USFWS 2002). Annual revenue sharing payments have been made to the county, based on a maximum of 0.75 percent of the fair market value of refuge lands, as determined by appraisal every 5 years. The actual amount varies each year, and is based on Congressional appropriations. Table 3.7 provides the amounts contributed to Chesterfield County between 2005 and 2010.

Table 3.7. Revenue Sharing Payments to Chesterfield County, Fiscal Years 2005 to 2010

Year	Acres	Full Payment	Actual Payment	Percent of Full Payment
2005	1,329	\$11,010	\$5,125	46.5 percent
2006	1,329	\$11,010	\$4,743	43.1 percent
2007	1,329	\$11,010	\$4,587	41.7 percent
2008	1,329	\$11,010	\$3,698	33.6 percent
2009	1,329	\$11,010	\$3,344	30.7 percent
2010	1,329	\$11,010	\$4,927	21.4 percent

The refuge also contributes indirectly to the economy of Chesterfield County and the Richmond Metropolitan Statistical Area by protecting wildlife habitat, or open space, in perpetuity. Other significant public recreational lands near Presquile NWR include Federal and State parks in the cities of Richmond and Chesterfield, and Hanover, Henrico, and Prince George Counties.

3.9 Special Status Areas

3.9.1 Federally Designated Special Status Areas

Federally designated special status areas include wilderness areas, national natural landmarks, research natural areas, experimental research areas, world heritage sites, biosphere reserves, wild and scenic rivers, national trails, national marine sanctuaries, Ramsar wetlands sites, Class I and Class II clean air areas, and critical habitat for endangered, threatened, and rare species management. Designated areas within the vicinity of the refuge are highlighted below.

Wilderness Area

As part of the planning process, we also evaluated all the federally owned (in fee title) lands on the refuge for their possible inclusion into the National Wilderness Preservation System. We completed a wilderness review for this CCP, with the recommendation that we not proceed further with a wilderness study because we determined that refuge lands do not meet the criteria for eligibility. Please refer to appendix D for the results of our assessment.

The closest designated wilderness area to the refuge is the Three Ridges Wilderness, which is located 80 miles northwest of the refuge in the George Washington National Forest in Nelson County, Virginia.

National Wild and Scenic Rivers

The National Wild and Scenic Rivers Act (16 U.S.C. 1271-1287) established a process for identifying free-flowing rivers deserving of Federal protection to preserve them and their immediate environments for the use and enjoyment of present and future generations. The NPS compiles and maintains the Nationwide Rivers Inventory, which is a register of river segments that potentially qualify as national wild, scenic, or recreational river areas.

Service planning policy requires us to conduct a wild and scenic river review during the CCP process if applicable. We did not conduct a wild and scenic river review for Presquile NWR because there are no rivers or segments of rivers that qualify for review within the refuge boundary.

The nearest river segment that has the potential for national wild and scenic river designation is a portion of the James River that begins downriver from Presquile NWR, at Hopewell City, to Mogarts Beach in Isle of Wight County, Virginia. This 62-mile segment is one of the most significant historic, relatively undeveloped rivers in the entire Northeast region. Within or adjacent to the corridor are four National Register sites and one National Historic Park (NPS 2009).

National Park System Units

Portions of four NPS units are within a 5-mile radius of Presquile NWR. The refuge is located on the James River segment of the Captain John Smith Chesapeake NHT, within the Chesapeake Bay Gateways and Watertrails Network (CBGN), just over 2 miles north of the City Point unit of Petersburg National Battlefield, and 3 miles south of the Glendale/Malvern Hill Battlefield unit of Richmond National Battlefield Park.

In October 2010, the Service and NPS signed a Memorandum of Understanding (MOU) regarding cooperation and collaboration on a variety of efforts within the Chesapeake Bay Watershed, including the Captain John Smith Chesapeake NHT and CBGN.

Captain John Smith Chesapeake NHT

Presquile NWR is located on the James River segment of the Captain John Smith Chesapeake NHT, and refuge staff actively participated on the interagency planning team to develop the James River Segment Trail Plan during 2011. Presquile NWR is within the Captain John Smith Chesapeake NHT's James River Oxbow focus area, along with Henricus Historical Park and the Dutch Gap Conservation Area. Combined, these sites have an annual visitation of over 145,000 people, the bulk of who visit the reconstruction of the second oldest English settlement at Henricus. The refuge has been identified as a key site for interpretation and education because it offers views reminiscent of the 17th century and Virginia Indian life, in marked contrast with the adjacent, heavily impacted industrial sites and lands (NPS 2011); additional details about the refuge's cultural landscapes are provided in section 3.12. Through continued collaboration, the Service and NPS will ensure that Captain John Smith Chesapeake NHT-related activities proposed to occur at Presquile NWR are implemented in a manner that is compatible with the purpose and intent of the refuge.



Cyrus Brame/USFWS

Canoeing along the Captain John Smith Chesapeake National Historic Trail

Chesapeake Bay Gateways and Watertrails Network

Established by Congress in 1998, the CBGN is a partnership of parks, wildlife refuges, historic sites, museums, historic vessels, environmental education centers, information centers, byways, and water trails that provides people with opportunities for meaningful Chesapeake Bay experiences. The primary goal of the CBGN as envisioned by Congress is to foster citizen stewardship of the Chesapeake Bay. The Chesapeake Bay Office of the NPS administers the CBGN program, officially designating gateways, and providing technical and financial assistance.

Petersburg National Battlefield

Petersburg, Virginia, was an important supply center to the Confederate capital during the Civil War. Both the Union and Confederacy recognized that severing the supply network of roads and railroads would force General Lee to leave both Petersburg and Richmond. General Grant established his headquarters at the small port town of City Point, located at the confluence of the James and Appomattox Rivers.

Richmond National Battlefield Park

As the industrial and political capital of the Confederacy, Richmond, Virginia was at the heart of the Civil War (1861 to 1865). Richmond was the physical and psychological prize over which the two American armies contended in battles throughout farm fields surrounding Richmond. Previously unknown places like Cold Harbor, Gaines' Mill, Malvern Hill, and New Market Heights attained national significance for the key battles that were fought in the vicinity of Richmond.

Presquile NWR is located approximately 3 miles south of Glendale and Malvern Hill. Often identified as one of the Confederate army's great lost opportunities, the Battle of Glendale was the next to last of the Seven Days Campaign. With the Union army in full retreat toward the James River in the face of Lee's offensive, the Southern army set its sights on the critical intersection at Riddle's Shop, often called Glendale and sometimes referred to as Charles City Crossroads. Most of the Union army would have to funnel through that bottleneck on its way to the river. The climactic battle of the Seven Days Campaign ended at Malvern Hill on July 1, 1862. Malvern Hill remains the best preserved Civil War battlefield in central and southern Virginia. Today, the battlefield's nearly unaltered appearance, rural setting, and extensive walking trails offer an ideal environment for visitors to study this battle.

Ramsar Wetlands of International Importance

The Convention on Wetlands of International Importance, commonly referred to as the Ramsar Convention due to its origination in Ramsar, Iran, is an intergovernmental treaty to promote the conservation and wise use of wetlands and their resources. The treaty was adopted in 1971 and includes many countries and nongovernmental organizations concerned about the increasing loss and degradation of wetland habitat. Signatories to the treaty have committed themselves to implementing the "three pillars" of the Convention: to designate suitable wetlands for the List of Wetlands of International Importance ("Ramsar List") and ensure their effective management; to work towards the wise use of all their wetlands through national land-use planning, appropriate policies and legislation, management actions, and public education; and to cooperate internationally concerning transboundary wetlands, shared wetland systems, shared species, and development projects that may affect wetlands (http://www.ramsar.org/cda/en/ramsar-about-sites/main/ramsar/1-36-55_4000_0__; accessed June 2012).

In 1987, the Chesapeake Bay Estuarine Complex, including its 10 tributary rivers, was placed on the Ramsar List (Site 375). This site was listed based on its rich diversity of estuarine habitats and associated fish and wildlife. Noted highlights include its particular importance for very large numbers of staging and wintering waterfowl and other waterbirds, habitat for threatened and endangered species, and the economic importance of its fishery. The James River, including the refuge, is part of this Ramsar site.

3.9.2 State or Local Government Designated Areas

Virginia Scenic Rivers

The Virginia Scenic Rivers Act of 1970 created a Statewide program to protect and preserve rivers, or sections of rivers, having natural or scenic beauty and cultural and historic interest. The Code of Virginia (§10.1-402) provides that the VDCR may fully review and make recommendation to Federal, State, and local agencies regarding the planning for use and development of water and related land resources so that scenic rivers resources are protected.

More than 529 river miles on 24 rivers have been recognized since 1975 (VDCR 2010). Thirteen additional rivers have been evaluated and found to qualify for scenic river designation. Presquile NWR is located along a section of the James River (Segment 48: James River-Orleans Street to Surry County) that

has been evaluated and found worthy of designation, but has yet to be designated (VDCR 2007).

Chesapeake Bay Preservation Areas

VDCR's Division of Stormwater Management, Local Implementation administers the coastal lands management enforceable policy of the Virginia Coastal Program which is governed by the Chesapeake Bay Preservation Act (Bay Act) (Virginia Code §10.1-2100-10.1-2114) and Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 10-20 et seq.). Under the Bay Act (Virginia Code §10.1-1200 et seq.), localities within the State's coastal zone have enacted programs designed to improve water quality in the bay through the mitigation of the impacts of development and redevelopment on sensitive environmental features such as streams, wetlands, floodplains, and highly erodible and highly permeable soils.

Resource protection areas and resource management areas have been designated in each locality; these areas consist of groupings of sensitive environmental features. Resource protection area features (tidal wetlands, certain non-tidal wetlands, tidal shores, and buffer areas) are the most sensitive; in general, only water-dependent uses may be constructed in a resource protection area. Resource management area features (highly erodible soils, highly permeable soils, and certain non-tidal wetlands) are less sensitive than resource protection areas features. Development in a resource management area requires that activities meet certain performance criteria designed to mitigate negative environmental impacts.

As defined by the county ordinance (Chesterfield County Office of Water Quality and Chesterfield County Planning Department 2002), the resource protection areas on the refuge are locations:

- Where surface water bodies occur.
- That are within 300 feet of the James River.
- Where tidal wetlands are within 1,000 feet.

The remaining portions of the refuge are located within a resource management area because:

- There are no surface water bodies within the area.
- The James River is more than 300 feet from the project location.
- The nearest tidal wetlands are more than 1,000 feet east of the project location.

Natural Heritage Conservation Sites

Natural heritage conservation sites are defined by the State as the habitat of rare, threatened, or endangered plant and animal species; unique or exemplary natural communities; and significant geologic formations. Two State natural heritage conservation sites are located near the refuge: the Turkey Island Conservation Site and the Curles Neck Conservation Site. The natural heritage resource of concern at both sites is the bald eagle (VDEQ letter dated January 25, 2012, regarding USFWS 2011 EA for proposed enhancement of overnight accommodations [Overnight Accommodations EA]).

VNHP has recommended that a natural heritage conservation site be established to include the refuge's northern marsh and adjacent lower marshes of Turkey Island Creek. Such a designation is intended to protect habitat for rare species, protect water quality, provide buffers from potentially detrimental land uses,

and help maintain ecological processes necessary for the perpetuation of the significant elements of the area.

Bald Eagle Concentration Areas

The refuge is also within the James River Winter and Summer Bald Eagle Concentration Zone designated by the VDGIF. As the winter and summer concentration areas have expanded or modified with the growth in eagle population, their boundaries are being redrawn based on summer and winter boat and aerial surveys. This new data has yet to be published; however, the large population of wintering eagles in the area provided the basis for designation and footprint of the Lower James River Important Bird Area, discussed below.

Anadromous Fish Use Area

According to VDGIF, the James River has been designated an anadromous fish use area. Six anadromous fish species occur in this portion of the James River: alewife, American shad, striped bass, blueback herring, yellow perch, and hickory shad. Striped bass are also known to occur in Turkey Island Creek, to the north of Presquile NWR.

3.9.3 Other Special Status Areas

Lower James River Important Bird Area

In 2007, the National Audubon Society designated the tidal James River and 1.9 miles landward on each side as an important bird area largely due to the high concentrations of bald eagles using this area during the winter and summer months. The oligohaline (brackish water with low salinity) portions of the Potomac, Rappahannock, and James Rivers are convergent zones for northern eagle populations in the winter, southern eagle populations in early summer, and year-round for the Chesapeake Bay population. Where mature forests containing suitable perch trees border the river, much higher numbers of eagles are found compared to more developed, fresher, or more saline portions of the river.

3.10 Refuge Administration

3.10.1 Staffing

Established in March of 1953, Presquile NWR is the oldest refuge in the Eastern Virginia Rivers NWR Complex. The term “refuge complex” is used to describe a situation where two or more individual refuges, typically in the same region of the State or adjoining states, are combined under a single refuge manager’s responsibility. When staff and other resources were redirected in 2000, management responsibility for Presquile and James River NWRs was transferred to the refuge manager stationed at the newly formed Rappahannock River Valley NWR. This three-refuge grouping was named the Eastern Virginia Rivers NWR Complex. In 2003, Plum Tree Island NWR, established in 1972 in Poquoson, Virginia, was also added to the refuge complex.

Current refuge complex staffing consists of eight positions. The following six positions are stationed at the Eastern Virginia Rivers NWR Complex headquarters located on the Rappahannock River Valley NWR in Warsaw, Virginia: refuge manager, deputy refuge manager, administrative assistant, wildlife biologist, law enforcement officer, and maintenance worker. The remaining two staff members, an assistant refuge manager and natural resource planner, are stationed at the Harrison Lake National Fish Hatchery in Charles City, Virginia. The refuge has also employed a stipend-funded, summer natural resources intern annually since 2004.

All the positions within the refuge complex share in the responsibility for all four refuge units. The refuge complex manager is responsible for determining the priorities for the refuge complex and how to distribute staff time and resources among the four refuges. Since 2003, one full-time employee has been

administering activities and providing visitor services at Presquile NWR, as well as at James River NWR and Plum Tree Island NWR, with assistance from other refuge staff as needed.

3.10.2 Budget

The funding for Presquile NWR comes out of the budget for the entire Eastern Virginia Rivers NWR Complex. Approximately 80 percent of the complex budget is allocated to Rappahannock River Valley NWR because it supports complex operations and is the largest refuge in the complex. Operational funding includes salaries, supplies, utilities, fuel, and all other operational activities (wildlife and habitat surveys and management) that are not funded by special projects. Base maintenance funds are used to repair vehicles, equipment, and facilities and have been generally stable over the past 5 years. Replacement of vehicles, larger pieces of equipment (tractor, backhoe), or larger facilities (buildings) are funded as projects. Annual funding fluctuates according to the number and size of projects funded in a given year (e.g., vehicle or equipment replacement, visitor service enhancements, and facility improvements) (table 3.8).

Table 3.8. Funding and Staff Allocations for the Eastern Virginia Rivers NWR Complex, 2005 to 2011

Year	Operations	Maintenance	Projects	Cost Share	Total Funding	Staff
2005	\$650,748	\$23,520	\$368,229	\$8,133	\$1,050,630	8.34
2006	\$588,006	\$24,535	\$474,459	\$11,272	\$1,098,272	8.00
2007	\$782,083	\$59,117	\$116,917	\$10,606	\$968,723	8.30
2008	\$734,535	\$22,034	\$41,283	\$2,469	\$800,321	8.35
2009	\$788,886	\$24,000	\$469,021	\$7,999	\$1,289,906	7.40
2010	\$823,579	\$27,016	\$38,771	\$54,172	\$943,538	7.00
2011	\$963,324	\$27,410	\$290,260	\$0	\$1,280,994	7.40

80 percent of the complex budget is allocated to Rappahannock River Valley NWR

20 percent is divided among the other three refuges; it is not divided equally

3.10.3 Lands

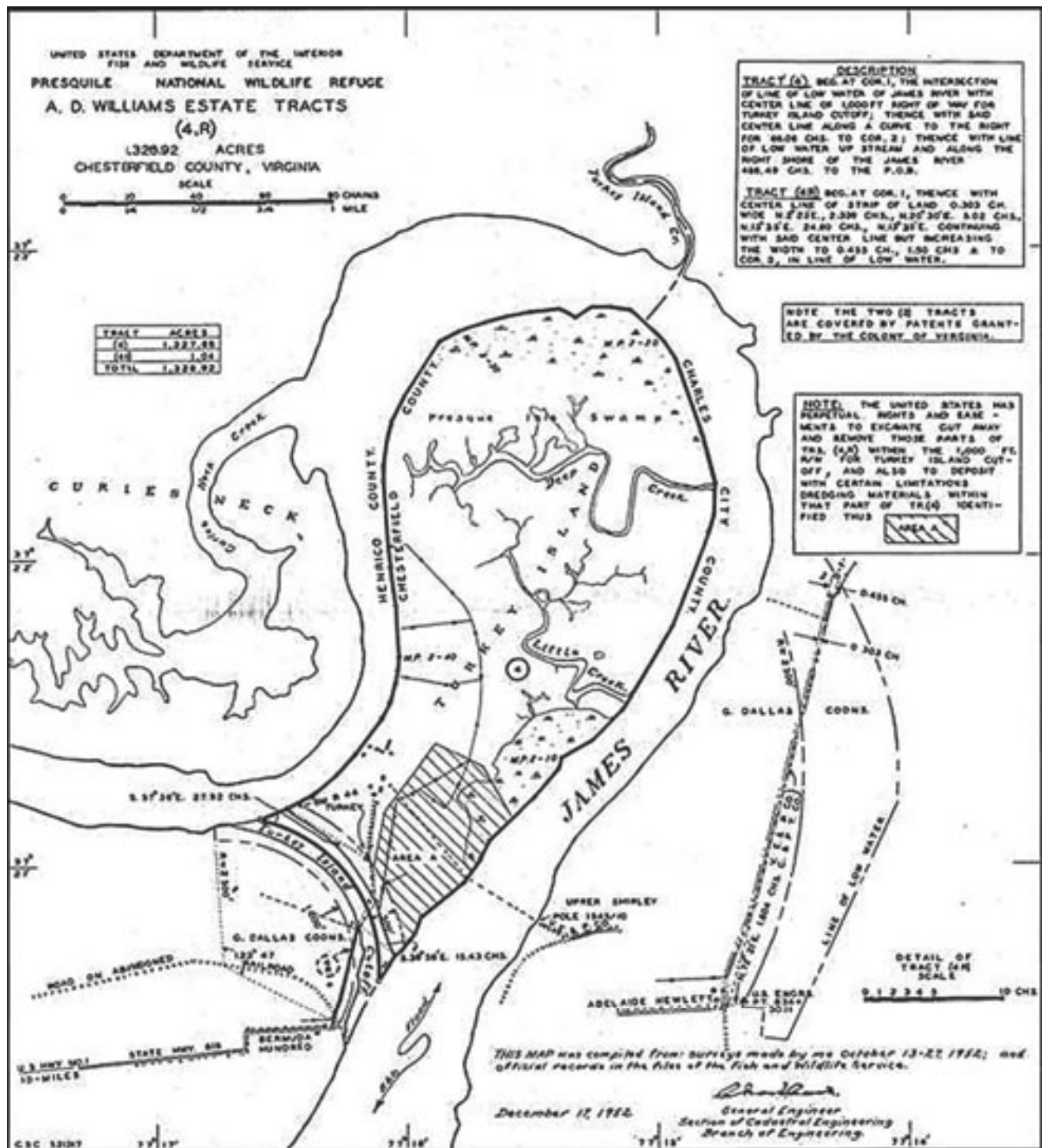
Land Acquisition History and Easements

The 1,329 acres of lands and waters that Mr. A. D. Williams bequeathed to the U.S. Department of the Interior were used to establish Presquile NWR. Those acres now include three easements (map 3.1).

The island portion of the refuge is bounded to the north, east, and west by the line of low water along the right shore of the James River, and on the southwest by the centerline of a 1,000-footwide right-of-way for the Turkey Island Cutoff. The USACE has perpetual rights to excavate, cut away, and remove lands in the Turkey Island Cutoff right-of-way and deposit dredge materials at a designated site on the refuge (labeled Area A on map 3.1). Based on a review of current and historic aerial photography, we have estimated that 12 acres of uplands adjacent to the Cutoff have eroded between 1968 and 2009. Although this erosion seems to be within the 500-footwide USACE easement on the refuge, we are concerned that continued erosion of this bank degrades water quality of the Lower James River and Chesapeake Bay, and threatens archaeological resources and refuge facilities.

An electric powerline is located on private property to the east of the refuge provides electric power service via submarine cable across the James River to the refuge's eastern shore.

Map 3.1 Original Easements as of Presquile NWR Establishment in 1953



A 1-acre, 30-footwide access easement is located on the Philip Morris USA Park 500 property and is bound to the north by the line of low water on the southside of Turkey Island Cutoff. This easement provides for refuge access via a gated access to an unimproved gravel road and use of the cable ferry's mainland terminal (see section 3.10.4 below for additional details). The Service and Philip Morris USA have maintained a good working relationship over the years regarding safety, security, and maintenance of the existing facilities and use of the site as a meeting location for refuge staff, partners, and visitors.

Future Potential for Additional Land Protection

Expanding the boundary of Presquile NWR is not currently a high priority for the Service. However, should land associated with the refuge's access easement on the Philip Morris USA lands and USACE Turkey Island Cutoff right-of-way become available, the Service would be interested in expanding the existing easement or acquiring it to enhance facilities to support refuge operations and visitor services, as well as wildlife habitat restoration.

Adjacent lands along the James River Oxbow are also of interest for land protection by the Service because they would enhance our ability to conserve migratory waterfowl in the existing area that is closed to waterfowl hunting. Additionally, protection of the lands adjacent to Turkey Island Creek would enhance non-motorized boating access and experiences associated with the Captain John Smith Chesapeake NHT. The Service would only consider lands offered by willing sellers.

Permanent protection of the more than 5,000-acre former dairy farm to the west of Presquile NWR, known as Curles Neck, would also enhance the conservation value of the area to migratory birds and native plant communities. However, acquisition of such a large tract, already impacted by human activity, can pose additional management difficulties.

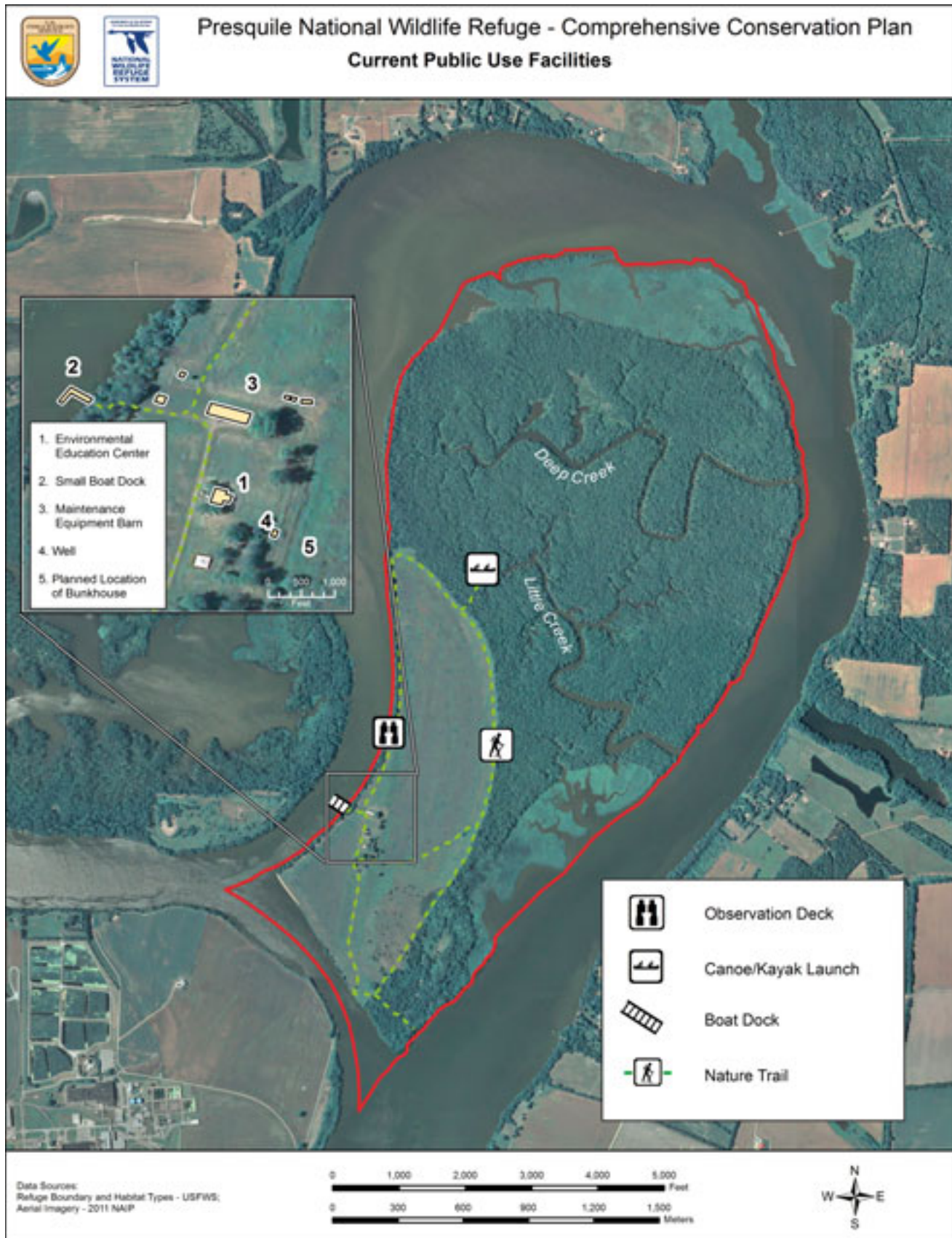
3.10.4 Facilities

Presquile NWR's cable ferry was constructed in the 1930s after creation of the Turkey Island Cutoff (map 3.1). It was originally used to support agricultural operations on the island. The ferry has a gasoline-powered motor that propels it along a 1-inch thick submarine cable. The cable ferry was used to transport refuge staff and visitors until 2001, when it was deemed unsafe for transporting refuge visitors by the U.S. Coast Guard. The ferry continues to be used for administrative purposes, such as transporting equipment.

The primary access point for refuge visitors is at a floating dock located on the western side of the island (map 3.2). With prior approval, visitors may access the refuge at a small kayak/canoe launch at Little Creek and boardwalk for wildlife observation, photography, environmental education, and interpretation. The low-impact kayak/canoe launch, gazebo, and 550-foot long boardwalk are a spur of the 3.5-mile nature trail, through the tidal swamp forest. Construction of the launch and boardwalk was partially funded by the CBTN grant. Refuge partners and volunteers completed its construction in 2011. Additional boat landing areas are authorized to support the refuge's 3-day public deer hunt. The public use area totals 23 acres, including the trails and maintained lawn surrounding the environmental education center, buildings, and boating facilities.

Buildings associated with refuge operations include an open-stall equipment storage barn, a few wooden and cinderblock storage sheds, and a small shed near the refuge's ferry terminal. We have recently completed building renovations to the environmental education center, are currently constructing a new bunkhouse facility, and anticipate needing to maintain these and other existing refuge facilities (see appendix C). A former ranch house now serves as the education

Map 3.2 Current Public Use Facilities on Presquile NWR



*Small boat
dock*



Cyrus Brame/USFWS

center in this public use area. It was recently renovated to become Leadership in Energy and Environmental Design (LEED)-compliant and American with Disabilities Act (ADA)-accessible. The facility has been named the “Menenak Discovery Center.” Menenak (pronounced: men-NEN-ak) is an Algonquin word, meaning island. The Menenak Discovery Center includes a small interpretive exhibit hall, a dining and meeting space, and two restrooms with showers.

In 2012, the Service approved a FONSI for the construction of a bunkhouse for overnight stays by the JRA Ecology School participants (USFWS 2012b). The sustainably designed and ADA-accessible bunkhouse will be funded and constructed by the JRA. The bunkhouse will offer safe, familiar, comfortable, and dependable shelter for up to 36 people. Construction began in the summer of 2012. The Menenak Discovery Center and bunkhouse support operation of the JRA Ecology School at Presquile NWR. Additional details about the Ecology School are provided in section 3.13.1.

Some other refuge facilities are in need of regular maintenance and repairs to restore or continue supporting refuge operations, protection of wildlife habitat, and public use (see appendix C for the complete list). As discussed in section 3.6, maintenance on the well was recently completed to verify the quality of the drinking water provided on the refuge. The buried septic system that supports restrooms in the environmental education center and equipment storage barn is due for an inspection and maintenance.

We are currently investigating options for improving the refuge’s transportation facilities and the potential for partnerships with nearby mainland marinas to support refuge operations and visitor access. In 2011, we contracted with Vanasse Hangen Brustlin, Inc. (VHB), using funds from a Paul S. Sarbanes Transit in Parks Program (49 U.S.C. 5320), to initiate a transportation study to investigate ways to maintain or improve access to this island-refuge for both refuge administration and visitor services purposes. The transportation study was completed in August 2012 and identified a range of feasible transportation system improvement options, including reuse or upgrade of the existing ferry system, an evaluation of nearby mainland marinas, or development of new facilities to accommodate a range of modes of access (VHB 2012).

3.10.5 Refuge Access Permit Requirement

Since its establishment, refuge managers at Presquile NWR have used the full range of discretion to manage public access, use, and recreation activities at the refuge by issuing special regulations, individual permits, or public notices in accordance with Service regulations (50 CFR 25 et seq.) and policies (603 FW 1, 603 FW 2, and 605 FW 1).

From refuge establishment through 2001, most visitors accessed the refuge on the federally owned and operated cable ferry. Refuge visitation has been affected by recent reductions in refuge staff, budget, and transportation capabilities. During the 1980s, three full-time employees and one part-time employee administered activities and facilitated visits by ferrying approximately 2,600 people to the refuge annually. In 2001, the U.S. Coast Guard deemed the ferry unsafe for continued transportation of the public to Presquile NWR. Since 2003, one full-time employee has been administering activities and providing visitor services at Presquile NWR, as well as at James River NWR and Plum Tree Island NWR.

Access to Presquile NWR is authorized through:

- Participation in a refuge-sponsored program.
- Participation in a partner-sponsored program for which the partner has been issued a general special use permit.
- An individual general special use permit.
- A hunting permit.

Instructions regarding refuge access requirements are provided on the refuge Web site: <http://www.fws.gov/northeast/presquile> (accessed May 2012).

We provide additional information regarding public uses at the refuge in section 3.13.

3.11 Refuge Natural Resources

3.11.1 Soils

The low-lying terrain of the refuge is characterized by either tidal marsh or mucky peat (swamp) soils. Most of the upland soils are moderately well-drained Toccoa fine sandy loam and well-drained Pamunkey loam developed from alluvium transported by the James River. Prior to 1934, this section of the river formed a large oxbow (USFWS 2004a). With the excavation of the Turkey Island Cutoff, some of the soil was deposited at the southeast side of the refuge (map 3.1). A summary of the characteristics of major soil types follows in table 3.9. Additional information can be obtained from the refuge headquarters.

According to Natural Resource Conservation Service (NRCS 2011), the Pamunkey and Dogue loam soils are prime farmlands. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. The lands within Presquile NWR were likely farmed by American Indian tribes for thousands of years prior to European settlement and farming of wheat, grain, sorghum, corn, and various other agricultural products (Goode et al. 2009). From its establishment until 2000, the Service farmed the uplands on Presquile NWR for the benefit of migratory waterfowl until 2000 (Brame personal communication).

Table 3.9. Summary of the Six Most Prevalent Soils Types on Presquile NWR

Soil Type	Local Landform	Hydric, Traits	Suitability	Acres¹ (percentage of total refuge)
Hydraquents ²	Tidal marsh/ Floodplains	Very poorly drained/ hydric; frequent flooding & ponding	Agriculture: Poor Silviculture: Poor	1,063 (80 percent)
Pamunkey Loam, 0 to 6 percent slopes	Stream terraces	Well drained	Agriculture: Good Silviculture: Good	173 (13 percent)
Chewacla Loam	Floodplains	Somewhat poorly drained; frequent flooding	Agriculture: Poor Silviculture: Poor	40 (3 percent)
Pamunkey Loam, 6 to 12 percent slopes	Stream terraces	Well drained	Agriculture: Good Silviculture: Good	26 (2 percent)
Toccoa Fine Sandy Loam, 0 to 4 percent slopes	Floodplains	Moderately well drained; frequent flooding	Agriculture: Fair Silviculture: Fair	26 (2 percent)
Dogue Loam, Variant, 0 to 4 percent slopes	Stream terraces	Moderately well drained; rare flooding	Agriculture: Good Silviculture: Good	2 (0.2 percent)
Total				1,329 (100 percent)

¹ Approximate. Includes streams and bays.

Source: Web Soil Survey 2.0, 2007.

3.11.2 Vegetation Communities and Associated Special Status Plant Species

Vegetation communities on Presquile NWR were mapped using the “ecological systems” classification system developed by Nature Serve. An ecological system is a “group of plant community types (associations) that tend to co-occur within landscapes with similar ecological processes, substrates, or environmental gradients.” A given ecological system will typically manifest itself in a landscape at intermediate geographic scales of tens to thousands of acres and will persist for 50 or more years (Comer et al. 2003). These units form a cohesive, distinguishable unit on the ground (USFWS 2007b). While “swamp” is the single largest general habitat category on the refuge, by far the most dominant ecological community within the tidal swamp forest is “red maple-green ash tidal woodland,” which dominates the northern half of the refuge. Map 3.3 depicts the current habitat management at the refuge.

In deriving the habitat types we refer to in this CCP, we grouped similar ecological systems into the broader habitat categories identified in table 3.10 since they effectively represent the scale on which management objectives and strategies are proposed in this CCP. However, subsequent planning for the step-down habitat management plan may make use of the more detailed mapping of habitat associations.

Map 3.3 Existing Habitat Types on Presquile NWR

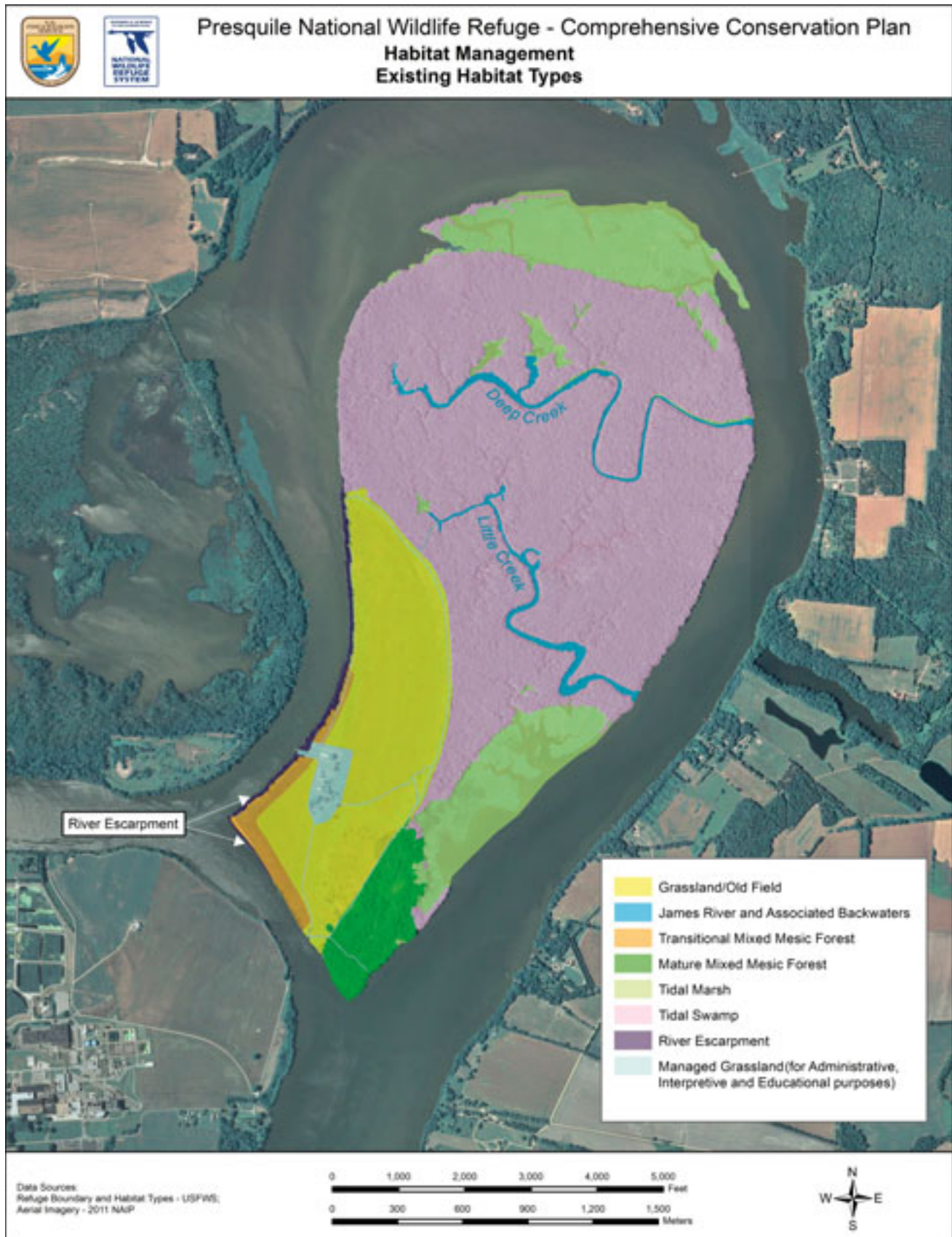


Table 3.10 represents how refuge habitat types were categorized, listing them in descending order by acreage.

Table 3.10. Refuge Habitat Types at Presquile NWR

Habitat Type	Acres*
Tidal swamp forest	738
Grassland, former croplands and pasture	200
Tidal freshwater marsh	189
James River and associated backwaters	101
Mature mixed mesic forest	46
Grassland, managed for administrative and educational purposes	23
Transitional mixed mesic forest	20
River escarpment	11
Right-of-way easements	1
Total	1,329

* Acres estimated from Geographic Information Systems (GIS) and rounded up to nearest whole number

Tidal Swamp Forest

Tidal swamp forest habitat at Presquile NWR includes a variety of ecological communities such as tidal woodland, bottomland forest, and saturated forest. The most abundant tree species are green ash, black gum, bald cypress, and red maple. Herbaceous plants are poorly represented in the swamp due to the dense canopy cover of the trees and susceptibility of the area to frequent inundation. Two large creeks and numerous tidal coves penetrate the tidal swamp forest (USFWS 2004a). The refuge’s tidal swamp forests also supports potential habitat for the Virginia least trillium, which is globally vulnerable, a Federal species of concern, and a State-imperiled plant species. Currently, the Virginia least trillium has not been documented on the refuge, but it generally inhabits alluvial woods and pocosin borders.

Tidal Freshwater Marsh

Tidal freshwater marsh is concentrated in two main areas at Presquile NWR: the northern tip and southeastern edge of the island. Tidal freshwater marsh habitat is tidally influenced within the refuge boundaries. This marsh type occurs in the uppermost portion of the estuarine zone of the James River, where the inflow of saltwater from tidal influence is diluted by a much larger volume of freshwater from upstream (USFWS 2007b). Salt concentrations in the James River near Presquile NWR range from a high of about 25 ppm in the summer to a low of 10 ppm in the winter. Predominant plant species within the saturated temperate and subpolar grasslands at the northern tip of the island include rice cutgrass and other graminoids (grass species), while the southeastern marsh consists of considerable open water and tidal herbaceous communities dominated by wild rice, salt marsh cordgrass, and arrow arum (USFWS 2004a).

The tidal freshwater marshes in the northern portion of Presquile NWR include a natural vegetation community and are inhabited by special status plant species. Because the refuge’s 189 acres of tidal freshwater marsh is a sizeable acreage of this natural vegetation community, it is considered significant by the VNHP (Belden et al. 2002). Sensitive joint-vetch is a member of the legume family that is federally and State-threatened,



Meghan Carfio/USFWS

Smooth beggartick (Bidens laevis) in the tidal swamp forest

globally imperiled because it only occurs in four coastal states, and is State imperiled in Virginia (Townsend 2007). The VNHP conducted surveys for rare plant species in 1998, 2000, and 2001 (Belden et al. 2002). In 1998, 5 individual sensitive joint-vetch plants were located on a small point bar within the northern marsh; in 2001, 38 plants were located along both sides of a small north-south channel in this same area. This element occurrence is located approximately 7.4 miles upstream from the previous most upstream records for the species on the James River (near Jordan and Harrison Points). A large population of another rare plant, the marsh senna, was also documented in the marsh at the northern end of Presquile NWR. Marsh senna is also a member of the legume family, is globally rare but secure, has a vulnerable ranking in Virginia, and is on the VNHP Watch List (Belden et al. 2002).

Grassland

The refuge has 223 acres of old field habitat on upland soils along the southwestern edge of the refuge and includes areas of pasture, former croplands, and maintained grassland. The grasslands are dominated by orchard grass, fescue grass, and clovers, while the uncultivated cropland is overgrown with Canada thistle, Johnsongrass, crab grass, and rye (USFWS 2004a). The maintained grassland area (23 acres) includes the frequently mown areas surrounding buildings and the nature trail network.

Mature Mixed Mesic Forest

Mature mixed mesic forest is limited in extent and occurs primarily in the southeastern corner of the refuge in the dredge spoils area or along the field edges. The dominant vegetation here includes eastern red cedar and the invasive black locust, all in somewhat open stands with thin herbaceous cover (USFWS 2004a).

Transitional Mixed Mesic Forest

Transitional mixed mesic forest is limited in extent and occurs within 300 feet of the refuge's western border. In order to restore degraded areas caused by fires and dredge spoils, since 1994 we have planted 20 acres with 18 different species of trees with assistance provided by partners, volunteers, and students. This effort is partially funded by the natural resource damage assessment and restoration settlement from the C & R Battery Company, Inc. Superfund Site. The restoration work conducted at Presquile NWR aimed to stabilize bank erosion, respond to the influx of nonnative grasses, and create wildlife corridors, while improving nesting and perching habitat for bald eagles, great blue heron and other wading birds, and other native wildlife (http://www.fws.gov/northeast/virginiafield/pdf/contaminants/2010May_fact%20sheet%20final_C&R.pdf; accessed April 2012).

River Escarpment

A narrow zone of river escarpment habitat is dominated by trees, primarily American sycamore, oak species, black cherry, hackberry, green ash, river birch, and woody vines. This area also includes invasive species such as black locust, European privet, and tree-of-heaven. This escarpment habitat averages about 50 feet in width and often occurs on slopes of 45 percent. It extends from the ferry landing to the southwest point of the island, and from there northeast and north to the wooded swamp (USFWS 2004a).

3.11.3 Nonnative, Invasive Plants

Federal management of nonnative, invasive plant species is guided by Executive Order 13112, "Invasive Species" signed on February 3, 1999. This Executive Order requires that a Council of Departments dealing with invasive species be created and develop a National Invasive Species Management Plan every 2 years. The first such plan was released in January 2001, providing the basis for Federal management of invasive species. The Executive Order defines an invasive species as a species that is nonnative to the ecosystem under consideration, and whose

introduction causes (or is likely to cause) economic or environmental harm, or harm to human health.

The presence of invasive plants can have an adverse impact on the biological integrity, diversity, and environmental health of refuges and other natural areas. Approximately 250 acres of grassland and early successional habitat on the refuge is treated with prescribed fire, mowing, and herbicides to reduce invasive plants. Listed below are several invasive plants that occur on the refuge which are impacting each of the habitats noted. The Service remains vigilant to their presence and spread, and a very active program to control many of them has been implemented (USFWS 2007b). The invasive species identified at Presquile NWR include:

Uplands

- Black locust
- Johnsongrass
- Canada thistle
- Japanese honeysuckle
- Japanese stilt-grass
- Tree-of-heaven
- Chinese privet

Wetlands

- Marsh dewflower
- Carpgrass

Uplands

Johnsongrass and Canada thistle are the predominant invasive upland species on Presquile NWR. The spread of these species has worsened in recent years. Control efforts, primarily herbicide use, has been hampered by logistics of getting equipment onto the island because of issues with ferry operation, or not having access to clean water. The latter issue was recently addressed. The highly invasive Japanese honeysuckle in the fields and forest edges and Japanese stilt-grass in the forest understory are also known on the refuge (USFWS 2006). Tree-of-heaven and Chinese privet are present in the wooded edges bordering the grassland.

Wetlands

Marsh dewflower was found on the refuge in September 2006 (USFWS 2006). This plant invades fresh tidal marshes and margins of lakes and ponds (Gleason and Cronquist 1991). Of particular concern, this invasive plant has been found in the vicinity of the federally threatened sensitive joint-vetch at the northern tip of the refuge.



Meghan Carfoll/USFWS

Grassland thick with Canada thistle and Johnsongrass

During a brief site visit on November 1, 2007, a consulting biologist observed small carpgrass along the edge of wetlands east of the ferry landing. This nonnative grass can reach 20 to 40 inches in height and displace native wetland plants.

Aquatic Habitats

No aquatic invasive species are known to occur within the refuge.

3.11.4 Climate Change Impacts on Vegetation

Upland Habitat Types

The refuge currently maintains the former cropland as early succession grassland, with grass, forbs, and shrubs on 200 acres and a buffer (generally 100-footwide) of planted trees on the high banks on the west and south sides. Some loss of uplands is expected due to sea level rise (see discussion below) but more may result from erosion, particularly if climate change produces dramatic fluctuations in weather patterns. The shorelines along the cut are high bluffs (20 feet) of unconsolidated and largely unvegetated sand, gravel, and clays that are caving into the river at a rate that has caused concern over the years. Eventually, the planted trees will mature but will topple as their root systems become undercut. Climate change impacts to the vegetation over the long term will also depend on what type of vegetation is being managed for on the refuge and what land use changes occur in the surrounding landscape.

The establishing language for the refuge, specifically to provide winter habitat for migratory geese, has guided past refuge management goals. Whether maintained as a grassland or forest, plant communities and species adapted to warmer subtropical latitudes are expected to expand and establish beyond the northern edge of their current range. If the grasslands are allowed to reforest, then an increase in mixed pines and southern oak species would be a likely scenario, depending also on the vegetation in the surrounding landscape.

Some possible positive effects on grasslands and forests from climate change include increased productivity through longer growing seasons, increased precipitation, and increased carbon dioxide fertilization which will increase primary production and yield greater biomass and soil inputs. Predicted increase in fire frequency (to a degree) would also be beneficial to native grasses that have deep root systems.

Some negative effects include extreme weather events causing damage and erosion, altered timing of aquifer recharge leading to potential declines in summer seasonal streamflow, species range shifts which would mean a decline of some species, increased severity in stress factors and increased susceptibility to disturbance. We may also expect expanded pest and disease ranges due to decreased probability of lower lethal temperatures, migrations to the north, and accelerated life cycles. Also, expected is an increase in the frequency or intensity of fire where there is less summer moisture. Mature trees, however, should fare better because of developed root systems and higher carbon reserves (Swanston et al. 2011).

The U.S. Forest Service assessed the current and predicted status of 134 tree species following climate change. Three global climate or general circulation models were combined to produce high or low averages that can be accessed through an interactive program, the Climate Change Tree Atlas, for displaying the range expansion (or contraction) of suitable habitat for each species by the year 2100 (<http://www.nrs.fs.fed.us/atlas/tree/>; accessed May 2012). Models are provided for green ash, black gum, bald cypress, and red maple, which are common species in the refuge's tidal swamp forest, as well as American sycamore, black cherry, river birch, black locust, eastern red cedar, and various species of oak, which are common in upland areas on the refuge.

Wetland Habitat Types

A significant increase in sea level rise would inundate most of the refuge wetlands. Excessive submergence drains carbon reserves from plants thereby reducing peat formation and plant productivity. Marshes would be converted to unvegetated mudflats. Moreover, rise in ambient temperature would reduce oxygen concentrations in the water column of eroded marsh embankments rendering them poor habitat for most fish species (USFWS 2007b).

Furthermore, highly organic sediment resulting from eroding tidal marshes presents problems for SAV. The loss of SAV beds has a huge impact on the ecology of the James River as well as the bay. SAV beds represent a critical habitat component for such species as waterfowl, fish, and other aquatic species including the economically important blue crab (USFWS 2007b).

Although the full effects of climate change will take longer than the 15-year planning horizon of this document, and predictions at this point are largely speculative without local, specific trend information, there are some generalizations that could be made. For example, increased sea levels will not only remove some wetland habitat, but extend or create it elsewhere, depending on topography. Increased storm events, drought, and flooding, will exert a form of natural selection on upland vegetation, creating greater age-class diversity than exists now, and promoting species structurally and physiologically able to withstand catastrophic events. We will likely see the rearrangement of vegetation communities according to their hydric (wet) or xeric (dry) affiliations.

In an effort to address the potential effects of sea level rise on national wildlife refuges, the Service contracted the application of the SLAMM for most Region 5 refuges. This analysis is designed to assist in the production of CCPs for each refuge along with other long-term management plans. SLAMM accounts for the dominant processes involved in wetland and shoreline changes during long term sea level rise. Tidal marshes are among the most susceptible ecosystems to climate change, especially accelerated sea level rise. Predicted global sea level rise scenarios range from a conservative estimate of 11.8 to 39.4 inches by 2100, to a moderate estimate of 19.7 to 55.1 inches, and to the upper extreme of 72 inches. The SLAMM model is based on the A1B scenario of climate change developed by the IPCC. The A1 family of scenarios assumes rapid economic growth, a rapid population growth that peaks mid-century and declines thereafter, and use of efficient technologies. The full SLAMM report is too lengthy to include in this document; however, it is available at the refuge office (Clough and Larson 2010).

The SLAMM report for Presquile NWR indicates that the refuge is highly vulnerable to the sea level rise scenarios modeled. It is important for the reader of this CCP to know that the SLAMM report also classified habitat types differently than we have for the purposes of this CCP. Regardless, the results of the SLAMM analysis indicate that tidal swamps are predicted to convert first to irregularly flooded marsh. They would then convert to regularly flooded marsh (potentially salt marsh depending on water salinity), then to non-vegetated tidal flats, and finally to open water. Under lower scenarios of sea level rise, only a small portion of tidal swamp is predicted to convert to marsh by 2100. Under higher scenarios, much open water and tidal flats become visible. The tidal swamp in the northwest corner of the refuge is most vulnerable because of its low elevation (Clough and Larson 2010).

These results are subject to considerable uncertainty, particularly due to poor elevation data for the refuge. Unfortunately, high vertical-resolution Light Detection and Ranging (LiDAR) elevation data were not available for this site (LiDAR is a remote sensing system used by the National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA) to collect topographic changes along shorelines). Elevation data used for model simulations were based on 1968 maps from the USGS National Elevation Dataset, with contour intervals of 10 feet. To determine the area of wetland types at risk, the National Wetlands Inventory was used based on a 1994 photo. Converting this National Wetlands Inventory survey into 30-meter cells and interpolating between the 10-foot contour intervals within the 1,329-acre refuge boundary provided the acreages of wetlands types shown in table 3.11 (Clough and Larson 2010).

Table 3.11. Results in Acres for Presquile NWR and IPCC Scenario A1B-Mean, 0.39-Meter Sea Level Rise Global by 2100 (Clough and Larson 2010)

Habitat Type	Habitat Acres (Percent of Total Acreage)				
	Year 2010	Year 2025	Year 2050	Year 2075	Year 2100
Tidal Swamp	735.7	725	698.2	661.5	622.9
	(56.8 percent)	(55.9 percent)	(53.9 percent)	(51.0 percent)	(48.1 percent)
Undeveloped Dry Land	287.6	286.1	280.7	277.7	271.3
	(22.2 percent)	(22.1 percent)	(21.7 percent)	(21.4 percent)	(20.9 percent)
Riverine Tidal	140.8	140.3	129.4	107.6	103.4
	(10.9 percent)	(10.8 percent)	(10.0 percent)	(8.3 percent)	(8.0 percent)
Tidal Fresh Marsh	126.3	126.3	126.3	126.3	126.3
	(9.7 percent)	(9.7 percent)	(9.7 percent)	(9.7 percent)	(9.7 percent)
Inland Shore	4.2	4.2	4.2	4.2	4.2
	(0.3 percent)	(0.3 percent)	(0.3 percent)	(0.3 percent)	(0.3 percent)
Swamp	1.3	1.3	4.7	4.7	8
	(0.1 percent)	(0.1 percent)	(0.4 percent)	(0.4 percent)	(0.6 percent)
Irregularly Flooded Marsh	0	10.7	37.5	74.2	112.8
	(0.0 percent)	(0.8 percent)	(2.9 percent)	(5.7 percent)	(8.7 percent)
Saltmarsh	0	0	0.5	1.6	3.5
	(0.0 percent)	(0.0 percent)	(0.0 percent)	(0.1 percent)	(0.3 percent)
Estuarine Open Water	0	0.4	11.3	33.1	37.4
	(0.0 percent)	(0.0 percent)	(0.9 percent)	(2.6 percent)	(2.9 percent)
Trans. Salt Marsh	0	1.4	2.9	5	6.1
	(0.0 percent)	(0.1 percent)	(0.2 percent)	(0.4 percent)	(0.5 percent)
Total Acreage	1295.9	1295.9	1295.9	1295.9	1295.9
	(100 percent)	(100 percent)	(100 percent)	(100 percent)	(100 percent)

3.11.5 Wildlife

Birds

Since 1953, the Hopewell Chapter of the National Audubon Society has included the refuge in its annual 1-day Christmas Bird Counts. The Christmas Bird Count is a long-standing program of the National Audubon Society. It is an early-winter bird census, where volunteers follow specified routes through a designated 15-mile diameter circle, counting every bird they see or hear over the course of the day. In 1953, the Hopewell chapter began including the refuge, since it is located within the 15-mile radius of the count circle. The varied habitats of the refuge encourage a diversity of avian species. To date, 103 bird species have been confirmed on refuge property from formal surveys and counts, of which 61 species are known breeders (Spencer 2010) and at least 73 species have been observed during the Christmas Bird Count when survey parties accessed the refuge (Richmond Audubon 2007). It should be noted that the total species list is surely underrepresented, since the logistics of access to the island has made frequent surveys difficult to achieve.

Presquile NWR occurs within BCR 30. At least 29 of the confirmed or highly likely bird species are priority species common to the Virginia State Wildlife Action Plan and BCR 30 Plan (ACJV 2007). High-priority species that occur on the refuge during breeding season include the bald eagle, prothonotary warbler, northern bobwhite, grasshopper sparrow, Louisiana waterthrush, and barn owl (ACJV 2007, VDGIF 2005). An active long-term program to study prothonotary warbler in partnership with Virginia Commonwealth University (VCU) is described below. Refer to appendix A for the refuge's comprehensive list of species of conservation concern.

Waterfowl

Presquile NWR was established to provide a resting and feeding area for thousands of migrating Canada geese and other waterfowl that winter in the area. The tidal tributaries of the lower Chesapeake Bay are especially important wintering grounds for waterfowl. In support of the refuge's purpose, the Secretary of the Interior designated certain lands and waters adjacent to Presquile NWR as areas closed to waterfowl hunting under the Migratory Bird Treaty Act as of April 22, 1954 (19 FR 2592). The bounds of the closed area were altered in a subsequent order published in the *Federal Register* on August 19, 1954 (19 FR 5290; codified at 50 CFR 32.8). The areas as described in the August 19, 1954 order remain closed to waterfowl hunting today, which includes, "All the area of the bed of the James River, submerged or exposed, including the waters thereof, in Charles City and Henrico Counties, Virginia, immediately contiguous to and abutting upon lands of the United States (Presquile National Wildlife Refuge)." Additional detail related to the bounds is provided in the order (19 FR 5290-5291).



USFWS

American black duck

The refuge has historically provided important wintering habitat along the Atlantic Flyway for wintering Canada geese (as many as 3,000) that breed along James Bay in eastern Canada. Canada geese are decreasing on the refuge as the grassland habitat becomes taller and shrubbier. Based on banding data, migratory Canada geese from the Southern James Bay have decreased substantially in the past 10 years (most of the geese using the refuge were from this region), while resident geese have been increasing in the surrounding agricultural landscape (Talbot and Ducey 2006).

VDGIF conducts aerial mid-winter waterfowl surveys throughout the Chesapeake Bay and its tributaries. The following information is based on 9 years of data, from 1998 to 2009 and pertains to a stretch of the river within 5 miles of the refuge. In parenthesis are the high counts for each species. The most dominant dabbling ducks are mallards (2,000) and American black ducks (1,300). Among the divers, the most numerous are ring-necked ducks (1,700) and merganser (3,000).

Among the geese and swan species, the most common species include Canada geese (over 8,000), snow geese (1,200) and tundra swans (5,400). During the 1998 to 2009 survey period, the highest waterfowl count was in the year 2004, with Canada goose accounting for over 8,000 of the total 10,752 waterfowl (VDGIF 2009).

In addition to the mid-winter waterfowl surveys flown by the VDGIF, the Christmas Bird Count also has provided some on-the-ground visual observations of waterfowl. Of the 30 species in the compiled 1997 to 2006 Christmas Bird Count, the most dominant included Canada goose, snow goose (white and blue phases), ring-necked duck, mallard, American black duck, double-crested cormorant, hooded merganser, lesser scaup, gadwall, and bufflehead. Table 3.12 below presents the full list of waterfowl observed for this 9-year period in alphabetical order. Any of these species may occur in nearby Curles Neck, Deep Bottom Creek, the tidal swamp forest, the emergent wetlands to the north and southeast, or rafting within the Proclamation Boundary just off the refuge's river

shoreline. Conservation status is presented for both BCR 30 and Virginia Wildlife Action Plan lists.

Table 3.12. Waterfowl Species Observed during the Christmas Bird Count 1997 to 2006

Species	Season of Occurrence¹	BCR 30 Priority Status	Virginia Wildlife Action Plan Tier²
American black duck	M, W, possible breeder	Highest	II
American wigeon	M, W	Moderate	
Blue-winged teal	M, W	High	
Bufflehead	M, W		
Cackling goose	M, W		
Canada goose	M, W		
Canvasback	M, W	High	
Common loon	M, W		
Common merganser	M, W		
Gadwall	M, W		
Greater scaup	M, W	High	IV
Green-winged teal	M, W		
Hooded merganser	M, W		
Lesser scaup	M, W		
Mallard	M, W		
Northern pintail	M, W		
Northern shoveler	M, W		
Red-breasted merganser	M, W		
Redhead	M, W		III
Ring-necked duck	M, W		
Ross's goose	M, W		
Ruddy duck	M, W		
Snow goose	M, W		
Surf scoter	M, W		
Tundra swan	M, W		
Wood duck	B, M, W		

¹ B = Breeding; M = Migrant; and W = Winter

² Virginia Wildlife Action Plan Tiers: I = Critical Conservation Need; II = Very High Conservation Need; III = High Conservation Need; and IV = Moderate Conservation Need

The refuge also provides important wintering habitat along the Atlantic Flyway for American black ducks. Populations of American black ducks have declined by as much as 60 percent on the wintering grounds and continue to be a species

of management concern (Steiner 1984, Whitman and Meredith 1987). Presquile NWR is among the sites participating in a 5-year (2010 to 2014) pilot population monitoring study being conducted by VDGIF. This pilot study was designed to assess differences in vital rates between black ducks banded during the pre-season and post season. Results of the study will be combined with results of the Mid-Winter Inventory and Eastern Breeding Waterfowl Survey to inform adaptive management actions and allow researchers and managers to assess model predictions, evaluate responses of black ducks to management, and track progress towards achieving the goals of the NAWMP (Costanzo 2012).

Shorebirds

Compared to the outer coastal plain, relatively few species of shorebirds use the more inland habitats of the James River watershed. Seven species of shorebirds of conservation concern (BCR 30 list) may occur on the refuge at various times of the year. The most familiar shorebirds in the refuge area are killdeer, American woodcock, and spotted sandpiper.

Six species of shorebirds were observed during the 1997 to 2006 Christmas Bird Count: killdeer, Wilson's snipe, least sandpiper, American woodcock, dunlin, and greater yellowlegs. The refuge supports a small amount of habitat suitable for these species: the narrow beaches and mudflats on the refuge shoreline, early succession and moist bottomlands, or emergent marshes to the north and southeast of the refuge. Woodcock are on the highest priority tier of the BCR 30 list, and are listed as being of very high conservation need (tier II) in the Virginia Wildlife Action Plan. Dunlins are listed as high on the BCR 30 list, and as of moderate conservation need (tier IV) in the Virginia Wildlife Action Plan.

Waterbirds and Marshbirds

Thirteen species of waterbirds and marshbirds were observed during the 1997 to 2006 Christmas Bird Count and included priority species such as American bittern, green heron, and Forster's tern. Ring-billed gull, laughing gull, herring gull, and great blue heron were observed in greatest numbers. As many as 284 great blue herons were counted within the circle in 1998 and the Lower James River Important Bird Area is known for several great blue heron rookeries along this portion of the river. During a 2003 colonial waterbird survey, researchers from the Center for Conservation Biology documented 557 active great blue heron nests and 10 great egret nests at four sites in the Curles Neck vicinity, located immediately west of the refuge (Harding personal communication 2012).

The list of waterbirds and marshbirds that have been observed within the Christmas Bird Count or are possible at the refuge are listed in table 3.13. Their season of occurrence and conservation status, where applicable, is also given.

Table 3.13. Waterbird or Marshbird Species Observed During 1997 to 2006 Christmas Bird Count

Species	Season of Occurrence¹	BCR 30 Priority Status	Virginia State Wildlife Action Plan Tiers²
American bittern	B?,M, W	Moderate	II
American coot			
Bonaparte's gull			
Forster's tern	B, M	High	IV
Double-crested cormorant	M,W		
Great blue heron			
Great egret			

Species	Season of Occurrence ¹	BCR 30 Priority Status	Virginia State Wildlife Action Plan Tiers ²
Greater black-backed gull			
Green heron			IV
Horned grebe	M,W	High	
Herring gull			
Laughing gull			
Lesser black-backed gull			
Pied-billed grebe	M,W		
Ring-billed gull			
Virginia rail			IV

¹ B = Breeding; M = Migrant; and W = Winter (BCR 30 Plan 2007)

² Virginia Wildlife Action Plan Tiers: I = Critical Conservation Need, II = Very High Conservation Need, III = High Conservation Need, and IV = Moderate Conservation Need

Landbirds

From the breeding landbird point count surveys from 2000 to 2004, 61 species of birds, primarily landbirds, were found to be breeding within the boundaries of the refuge, including those mentioned above. The most abundant breeding species (combined for all years) are indigo bunting, European starling, prothonotary warbler, grasshopper sparrow, northern cardinal, American goldfinch, and blue-gray gnatcatcher.

Table 3.14 below shows 21 landbirds that are BCR 30 priority species (2007), have Virginia Wildlife Action Plan tier categories, and have been observed or are likely to occur during the breeding season at the refuge. Their season of occurrence is also given.

The Christmas Bird Count records for 2004 to 2006 indicate the following as dominant species of landbirds during the early winter period: red-winged blackbird, European starling song sparrow, American robin, savannah sparrow, mourning dove, northern cardinal, white-throated sparrow, and eastern bluebird. In addition, raptors, such as northern harrier and red-shouldered hawk are easily observed in the winter months.

Table 3.14. BCR 30 and Virginia Wildlife Action Plan Landbird Priority Species Known or Suspected at Presquile NWR

Species	Season of Occurrence ¹	BCR 30 Priority Status	Virginia Wildlife Action Plan Tier ²
Bald eagle	B, M,W	Moderate	II
Black and white warbler	B,M	High	IV
Brown thrasher	B, M	High	IV
Chimney swift	B, M	High	IV
Eastern kingbird	B, M	High	IV
Eastern towhee	B, M	High	IV
Field sparrow	B,M,W	High	IV

Species	Season of Occurrence ¹	BCR 30 Priority Status	Virginia Wildlife Action Plan Tier ²
Grasshopper sparrow	B, M	Moderate	IV
Gray catbird	B, W	Moderate	IV
Kentucky warbler	B, M	High	IV
Louisiana waterthrush	B, M	High	IV
Northern bobwhite	B, W	High	IV
Prairie warbler	B, M	Highest	IV
Prothonotary warbler	B, M	High	IV
Rusty blackbird	M, W	High	IV
Scarlet tanager	B, M	High	IV
Whip-poor-will	B, M	High	IV
Willow flycatcher	M	High	IV
Wood thrush	B, M	Highest	IV
Worm-eating warbler	B?, M	High	IV
Yellow-throated vireo	B, M	High	IV

¹ B = Breeding; M = Migrant; and W = winter

² Virginia Wildlife Action Plan Tiers: I = Critical Conservation Need; II = Very High Conservation Need; III = High Conservation Need; and IV = Moderate Conservation Need

Bald Eagle. The bald eagle was removed from the Federal list of threatened and endangered species in July 2007. However, it is important to note that the bald eagle is still afforded special protection through the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, and retains its threatened status under the Virginia Endangered Species Act. The bald eagle currently is globally secure, is imperiled to uncommon as a breeding species and rare to uncommon as a non-breeder in Virginia, and remains State threatened. The Virginia Wildlife Action Plan lists the species as being of very high conservation need (tier II) as it occurs within a very limited distribution (VDGIF 2005). The Chesapeake Bay-Virginia bald eagle population favors mature, supercanopy trees that overlook a broad expanse of marsh, river, or fields with relatively clear understory below and in close proximity to water bodies where fish are abundant. In Virginia, bald eagles more frequently use pines, but nests are also found in beeches and bald cypress. Pines, hardwoods, or snags with extended branches free of obstructing vegetation are favored for perches. The forested riparian habitats along the tidal portion of the James River and the abundant fish made this area ideal bald eagle habitat (USFWS 2007b).

Presquile NWR occurs within the summer and winter concentration area for bald eagles along the James River watershed (VDGIF 2008b). Bald eagles nest, roost, and winter on refuge lands. Known nests include one along the northwest edge and one along the southeast edge of the refuge. Protecting and enhancing their habitat on the river is a priority on this refuge.

The refuge observes measures to limit disturbance to nests during the breeding season and roosts and important forage areas during the year. The Service and VDGIF have developed general guidelines to protect bald eagles at various times of the year. During the nesting season (December 15 to July 15), restrictions for human activity include buffer zones of 1,320 feet around nests, while restrictions for timber cutting and any other disruptive operations are designated from October 1 through February 28 (USFWS 2003). Also, prescribed burns are conducted at times when there will be the least impact on wildlife, especially for eagles. Spring and summer burns occur prior to, or after, the prime nesting season for ground-nesting birds, and a 750-foot buffer is maintained away from eagle nesting trees (USFWS 2004).

Visitors on the refuge are restricted from certain areas surrounding the known nest sites during the breeding season, as well as sensitive areas during the wintering season. Without such restrictions, eagles may abandon their nests and young during the breeding season and may experience additional stress and mortality during the wintering season.

During the past several years, one or two eagle nests have been active within the refuge. Statewide, annual surveys have been conducted for breeding bald eagles by the Center for Conservation Biology at the College of William and Mary since 1977. A total of 560 bald eagle nesting territories were determined to be occupied in Virginia during the 2007 breeding season (Watts and Byrd 2007). When compared to 2006, this represents a 15.5 percent increase in the breeding population, and a 28.7 percent increase since 2003. Within the James River watershed, active eagle nests increased 4 percent from 2006 to 2007, and a 51 percent increase since 2003. Chick production of 1.88 per nest in 2007 was up slightly from 1.83 per nest in 2006, and was a notable increase from 1.65 per nest in 2003. Within Chesterfield County, active nests increased from 5 to 10 and chick production was more or less steady at 8 in 2003 and 2007 (Watts and Byrd 2003, 2006, and 2007). During the 2010 breeding season, the annual survey documented 684 occupied territories in Virginia. This number represents an 11.8 percent increase over 2009. The number of active nests increased by 10.2 percent and 136 new nests were mapped. Occupied territories were located within 47 counties and 10 independent cities.

The majority of known territories continue to be concentrated within the coastal plain with less than 5 percent of pairs occurring in the piedmont and mountains. A total of 883 chicks were counted during the productivity flight. This is the highest chick production recorded during the 34-year history of the survey. The Virginia population continues to have tremendous reproductive momentum. Of 10,092 chicks documented in the past 34 years, 8.7 percent were produced in 2010 and 70.7 percent were produced since 2000 (Watts and Byrd 2010). Within Chesterfield County, there were 11 occupied territories, 11 active nests, 14 chicks produced, and 1.27 chicks per active nest (Watts and Byrd 2010). At the James River level, there were 133 occupied territories, 126 active nests, 199 chicks produced, and 1.58 chicks per active nest (Watts and Byrd 2010).

Prothonotary Warbler. The prothonotary warbler is one of the species that led to the nomination of the Lower James River Important Bird Area (Audubon VA IBA Program 2007). The prothonotary warbler is the only wood warbler in the eastern U.S. that breeds in tree cavities. The species is declining over much of its breeding range, from Florida north to Wisconsin. Because of its specific breeding habitat needs (Flaspohler 1996), the greatest threat to this bird in Virginia and the southeastern U.S. is destruction and degradation of habitat and the conversion of lowland forests by logging and agricultural practices (Petit 1999). The prothonotary warbler prefers lowland forests near standing water for nesting sites and, in Virginia, is primarily found along the tidal portions of rivers that flow into the Chesapeake Bay, including the James River. Natural



Daniel Lay

Prothonotary warbler chick

nest cavities used by the prothonotary warbler are those excavated by woodpeckers and other cavity builders, although nest boxes supplied by humans are readily occupied.

Since 1987, the VCU Department of Biology has conducted annual breeding studies of prothonotary warblers at Presquile NWR. Initially, the primary study question to address was whether a major contributor to their population decline was habitat destruction and fragmentation on their breeding grounds, causing a lack of nesting substrate and high predation and parasitism rates (Viverette personal communication 2012). To study this question, a nest box program was instituted to study productivity, produce large numbers of fledglings, and offer better protection from predation and parasitism through vigilant

observations and monitoring. The research questions have since expanded beyond this as evidenced by more than 20 publications that have resulted. Some of the findings are presented below.

Over the years, as many as 283 nest boxes were placed to facilitate research, primarily along the two internal channels and streams on the refuge. Presently, the number of nest boxes is approximately 150 (Viverette personal communication 2012); however, recent discussions with refuge staff involve consideration of a further reduction to reduce maintenance needs and encourage bird use of natural cavities. The boxes allow easy access to the birds, in particular the nestlings and adult females, allowing researchers to follow each stage of nesting and development and easily capture and handle birds (e.g., for banding and collecting tissue samples such as blood samples for genetic or blood parasite work, and feather samples for isotope work). The large number of boxes at multiple sites allows a level of experimental control, and sufficient numbers for statistical analysis, that is unusual in many avian studies. Researchers would not be able to reproduce the kinds of research that has been, or is being conducted, using natural cavities. The kind of access and experimental control, as well as large sample sizes, is particularly important to students conducting master thesis research because they have a short window of time to conduct the research. In addition, over many years, this access has provided a robust long-term data set. Being able to follow individual birds over multiple years is particularly important for studies currently underway relating to a host of questions about individual fitness, as well as habitat connectivity.

Nest boxes are typically placed at 3 to 6.5 feet above the highest high tide and are spaced approximately 330 feet apart. During the breeding season (April to July), nest box activities include monitoring for nestling activity, as well as weighing, measuring, and banding, and taking blood samples to look for parasites and mercury levels.

Data obtained during VCU studies done on the refuge from 1987 through 2003 indicate an average number of adult females banded per breeding season was 26.5 from 1987 through 1994, while from 1995 through 2003 it was 74.2 (a 280 percent increase). Similarly, the average number of young birds annually banded was 91.9 from 1987 through 1994, while from 1995 through 2003 it was 611.5 (a 665 percent increase). Except for the spring of 2003 when over 100 nests were abandoned with eggs present (Blem and Reilly personal communication 2003), nest abandonment has not been an issue during banding studies (but predation by predators and subsequent nest abandonment may be a contributing factor in the species decline elsewhere throughout their range). The most frequent

number of eggs per early clutch was 5 (61 percent of all nests), while for late clutches it was 4 (69 percent of all nests). Early clutches varied from 3 to 7 eggs, while late clutches varied from 2 to 7 eggs. The date of first egg laying (for first clutches) varied from April 17 to April 28. Eggs are laid one per day, and have an incubation period of about 12 days, beginning with the last egg. In regard to nest boxes, 141 were established in 1987, and had increased to 320 boxes by 2003. The number of nests with at least one egg began with 51 in 1987 (36 percent) and was at 303 in 2003 (95 percent). Approximately 12.6 percent of all boxes during the 17-year period produced two nests (Blem and Reilly personal communication 2003).

VCU has also been examining productive success relative to female plumage, as females with plumages most resembling male breeding plumage appear to have higher mating success rates, migration return dates in response to climate change, screening for infectious diseases such as avian influenza and West Nile virus, diet studies using stable isotopes, and characterization of the population structure across small (e.g., the tidal James River) and large geographic areas (e.g., across the breeding range) using microsatellite DNA markers.

The research conducted by VCU has resulted in publication of over 20 manuscripts in scientific journals, 5 graduate theses, and 8 undergraduate research projects. This research has significantly contributed to the body of scientific knowledge about this species' breeding ecology, feeding behaviors, and parasite burden, as well as offering clues about how climate change may affect this species.

Rusty Blackbird. Another declining priority species for which the refuge has potential habitat is the rusty blackbird. Their primary habitat is wooded wetlands but they occasionally join large flocks of blackbirds in open fields in the winter. In 2006, 1,054 rusty blackbirds were observed during the Christmas Bird Count near the refuge. However, rusty blackbird populations have been declining by as much as 88 percent in the past few decades according to data gathered between 1966 and 2006 for the North American Breeding Bird Survey and Christmas Bird Counts, prompting a call for a National Rusty Blackbird Blitz in 2010 (eBird 2010). The species is more insectivorous than other blackbirds. Observers suggest that the species is wary of new foods or situations, making it less adaptable than other blackbirds in taking advantage of opportunities. A number of factors may be responsible for their decline on wintering and breeding grounds. In the winter, conversion of up to 80 percent of hardwood bottomlands to agriculture may have forced them into open habitat where they must compete with birds such as common grackles and red-winged blackbirds. The species experienced large losses on their wintering ground because of control programs in the 1960s and 1970s. Some states consider the rusty blackbird as a pest species. Breeding habitat loss and degradation, including boreal wetland drying and changes in water chemistry is due, directly or indirectly, to global warming and changes in the vertebrate community. Other birds associated with boreal wetlands have shown declines also (Greenberg 2010).

Birds and Climate Change

According to a recent analysis of Christmas Bird Count data over the past 40 years, a significant northward shift of the winter center of abundance is occurring among at least 305 bird species in North America (Niven et al. 2009). Of these bird species, 208 shifted north, with 123 species shifting more than 50 miles. Landbirds shifted more than waterfowl or coastal species. Seventy-five percent of landbirds shifted north an average of 48 miles. Landbirds were further analyzed according to four habitat guilds: woodland, grassland, shrub, and generalist. Woodland birds shifted the most, followed by shrub species, while grassland birds and generalist shifted the least. This study confirmed northward shift of species already suspected, such as red-bellied woodpecker, tufted

titmouse, Carolina wren, and northern cardinal, which are all common species at the refuge throughout the year. It may not be possible to separate climate change influences from forest management influences over the 15-year planning horizon of this document.

Waterfowl range contraction is anticipated as milder, warmer winters shift northward, reducing the need for waterfowl to migrate as far south. Fewer waterfowl now winter in the Chesapeake Bay area, attributed to climatic changes occurring in the breeding grounds of the Prairie Pothole region, milder winters further north, and decline of eelgrass in the bay (from warmer water temperatures, turbidity, and sea level rise) (VDGIF et al. 2009).

Impaired water quality of the James River due to climate change effects such as increase erosion, turbidity, water temperatures, could indirectly affect the bald eagle population by impacting fish, the species' primary prey base.

Mammals

According to VDGIF and Linzey (1998), approximately 45 to 49 mammal species occur in Chesterfield County (VDGIF 2010). The field mouse is the most abundant mammal species on the refuge and is found in all habitat types. Deer, raccoon, gray squirrel, woodchuck, eastern cottontail rabbit, striped skunk, and muskrat are common mammals for this part of Virginia. Little brown bat, red fox, and American beaver are known to live on the refuge (Jackson et al. 1976, USFWS 2004a) and river otter have been observed on the refuge through use of wildlife cameras. Bobcat and coyote may also be on the island, as they are in the surrounding area, but to date, there have not been any conclusive observations.

Several mammal species of concern potentially occur on Presquile NWR. The cotton mouse is listed as a species of moderate conservation need (tier IV) in the State Wildlife Action Plan and has a range that may include the refuge. The marsh rabbit has been found in Surry County and is also a species of moderate conservation need (tier IV). The southeastern fox squirrel may possibly be extending its range northward; although suitable habitat for this species



Raccoon

is not abundant, it is a species of high conservation need (tier III) in the Wildlife Action Plan. Southeastern myotis is a species of moderate conservation need (tier IV) in the bat family that has potential to occur on the refuge. An individual was recently discovered in Chesterfield County (Hobson personal communication 2010) flying erratically in broad daylight near Pocahontas State Park. It was captured and diagnosed with white-nosed syndrome, rabies, and mites. The Rafinesque eastern big-eared bat is a species of critical conservation need (tier I) which also may occur on or near the refuge, as it has been recorded in several nearby counties (Linzey 1998, VDGIF 2005). More information on bat diversity and distribution in the area of the refuge is needed. Although the refuge has no caves, and likely no rock crevices, a number of bats use hollow trees, clumps of leaves, even Spanish moss for roosting. With so much hardwood bottomland forest and swamp adjacent to marsh and old field and old farm buildings, the refuge likely provides ideal habitat for several bat species.

Bill Wood

Reptiles and Amphibians

The refuge's marsh and swamp habitats are especially rich in reptilian life.

Within a 3-mile radius of the refuge, about 79 species of reptiles and amphibians potentially or likely occur (VDGIF 2010). Of these, there are 20 species of frogs or toads, 14 species of salamanders, 12 turtle species, 26 snake species, and 7 lizard or skink species. Sixteen of the species have State status or are tiered species in the Virginia Wildlife Action Plan, and includes such species as barking treefrog (State-threatened, tier II), northern diamond-backed terrapin (collection concern, tier II), eastern box turtle (tier III), spotted turtle (collection concern, tier III), eastern spadefoot toad (tier IV), and eastern hog-nosed snake (tier IV).



Cyrus Brame/USFWS

Snapping turtle

Riparian forests and wetlands along the James River provide excellent breeding and foraging habitat for many species of reptiles and amphibians. Few baseline surveys have been conducted at Presquile NWR, but snapping turtle, brown water snake, eastern painted turtle, and eastern red-eared sliders can easily be found basking on downed logs in the creeks of the tidal swamp forest.

Depending on the time of year, this same swamp would host choruses of green tree

frogs, spring peepers, Fowler's toads, southern leopard frog, and green frog. During a survey for reptiles and amphibians conducted in spring 2006 by the Virginia Herpetological Society, species observed included several black racers, eastern worm snake, eastern garter snake, and most notably, eastern mole king snake. In addition, a five-lined skink, Fowler's toads, and a Cope's gray treefrog were observed.

While conducting the reptile and amphibian survey, the Virginia Herpetological Society examined individual animals for evidence of parasites, infection, or malformities. Of particular note, many of the eastern fence lizards caught were found to be heavily infested with ticks. Also at that time, a snake lesion and blood sampling study was initiated for non-threatened and non-endangered snakes. Researchers placed tin and wood cover boards as well as drift fences, funnel and pitfall traps to capture snakes. Snakes that were captured were analyzed for lesions and biopsied, if appropriate had blood samples taken and were tagged prior to release. This study was prompted by an earlier study conducted at the Rappahannock River Valley NWR in June 2005, where an unusually high incidence of skin lesions and eye infections were noted among several species of snakes. Researchers sought to expand their investigations to James River and Presquile NWRs to determine the extent and find clues for potential causes. No major concerns have been noted to date with populations on Presquile NWR; however, studies are still ongoing (Ware personal communication 2012).

Fish

At the county level (i.e., Chesterfield County), 59 species of fish are presently listed by VDGIF. Twenty of these species are considered game fish (VDGIF 2010).

Although a complete inventory of fish in the refuge vicinity has not been conducted, these are among the more commonly occurring fish species: white perch, blue catfish, striped bass, largemouth bass, hogchoker, bluegill, pumpkinseed sunfish, and American eel (Spells personal communication 2011).

The following species of fish may find suitable spawning and nursing sites within the James River and the two large creeks that bisect the refuge: bridle shiner, alewife, blueback herring, American shad, gizzard shad, and hickory shad. Small tributaries to the larger creeks and associated wetlands serve as important nursery areas for resident fish species. Other aquatic habitats within the refuge or adjacent to the refuge may be inhabited by other small fish (killifish and mosquitofish) (Spells personal communication 2011).

Atlantic Sturgeon

In February 2012, NOAA's Fisheries Service announced the listing of the Chesapeake Bay population and four other distinct populations of Atlantic sturgeon as federally endangered. It is a globally vulnerable species that is imperiled in the State.

According to State fishery biologists, a small but viable sturgeon population occurs in the lower James River (Richmond Times Dispatch, April 15, 2007) and the James River remains one of the best places in the Chesapeake Bay watershed to find sturgeon. There is recent evidence that sturgeon spawning in the James River is occurring in the spring and in the fall (Richmond Times Dispatch, May 3, 2011 and September 26, 2012; Balazik et al. 2012). Scientists netted more than 200 sturgeons between 2005 and 2006, many between Hopewell and Newport News, leading some to speculate that a comeback was underway. An estimated 9-foot sturgeon was briefly captured by VCU biologists just upriver from Hopewell on September 18, 2007 (Richmond Times Dispatch, September 29, 2007). This prompted JRA to partner with State and private entities to construct an artificial spawning reef adjacent to Presquile NWR in 2010. Partner agencies and organizations are conducting ongoing monitoring to evaluate whether or not the artificial reef site is promoting spawning by sturgeon. Other fish species have been noted to use the area for spawning. However, use by sturgeon has not been confirmed to date (Fredrickson personal communication 2011). Refuge staff have also worked with partners involved in the tagging and recapture of sturgeon as well as preliminary studies to investigate potential effects of river channel dredging on the population. An adult female sturgeon was caught in the James River near Presquile NWR in the spring 2012 for the first time in 3 years (Brame personal communication 2011).

Other Special Status Fish Species

Alewife (tier IV) and blueback herring were recently proposed for Federal listing as threatened in the *Federal Register* (76 FR 67652) primarily due to concerns with habitat loss, habitat alteration, impaired water quality, and overutilization. According to this *Federal Register* Notice, the substrate preferred for spawning varies greatly and can include gravel, detritus, and SAV. Blueback herring prefer swifter moving waters than alewife.

American shad



Duane Raver/USFWS

The bridle shiner (State special concern, tier I) spawns in still shallow water near shore where vegetation is present, such as tidal freshwater marshes (Burkhead and Jenkins 1991, Scott and Crossman 1973).

American shad, gizzard shad, and hickory shad use backwater and slow water areas, such as the side channels and open waters on or adjacent to the Presquile NWR (Manooch 1984, Ross et al. 1993). American shad are also a species of concern in areas of their range. They were historically considered an important food source for American Indians and European settlers (Hilton et al. 2011). A commercial fishery in the

Chesapeake Bay grew, and by 1897, 11.5 million pounds were harvested (Virginia Institute of Marine Science, http://www.vims.edu/research/departments/fisheries/programs/american_shad/index.ph; accessed April 2012). By 1982, less than 1 million pounds were harvested. In 1994, the Virginia Marine Resources Commission issued a moratorium on American shad harvest in the Chesapeake Bay and its tributaries. In addition to overfishing, habitat degradation such as pollution, dams, and land use changes have caused a decrease in the American shad population of the Chesapeake Bay and its tributaries (ASMFC 2007).

Species of fish that are listed in the Virginia Wildlife Action Plan and in the Virginia Fish and Wildlife Information Services Biota of Virginia Database for a 3-mile radius from the refuge are listed in table 3.15. Federal and State status is also included when applicable. A list of potential fish species of conservation concern for the waters around the refuge is provided in the appendix A.

Table 3.15. Virginia Wildlife Action Plan Fish Species Known or Suspected at Presquile NWR

Common Name	State and Federal Status¹	Virginia State Wildlife Action Plan Tier²
American Brook Lamprey		IV
Atlantic Sturgeon	FE, SS	II
Alewife		IV
American Shad		IV
American Eel		IV
Banded Sunfish		IV
Bridle Shiner		I
Least Brook Lamprey		IV
Mud Sunfish		IV

¹ FE = Federally Endangered; ST = State Threatened; and SS = State Species of Concern

² Virginia Wildlife Action Plan Tiers: I = Critical Conservation Need; II = Very High Conservation Need; III = High Conservation Need; and IV = Moderate Conservation Need

Invertebrates

This taxon is the least studied and understood group of animals on the refuge. During warmer seasons, the refuge supports a wide range of aquatic insects, butterflies, beetles, and other invertebrate species. Monarch, red admiral, sulphurs, buckeye, painted lady, and eastern tiger swallowtail are some of the more common butterfly species. No rare or listed insect species were collected during the 2002 Natural Heritage Inventory conducted by the VNHP. An insect survey on the refuge in July 17, 2007 yielded 30 species, most of which were butterflies and skippers. Of special interest are the native bees and beetles that were also recorded (Wirth et al. 2007). A diversity of native insects, especially specialists that are associated with a single or only a few plant lineages, is suggestive of a healthy ecosystem. The short list is presented in table 3.16 below.

Two species of shellfish of conservation concern may also occur on or near the refuge: the alewife floater mussel (tier IV) and the green floater mussel (State threatened; tier II).

Table 3.16. Insecta Collected During July 2007 Survey at Presquile NWR by the University of Richmond

Category	Family	Common Name
Ants	Mutillidae	Velvet ant
Bees and Wasps	unknown	Small bee
	Apidae	Hibiscus bee
	Megachilidae	Leaf-cutting and resin bees
	Vespidae	Potter wasps
Beetles	Cicindelidae	Sidewalk tiger beetle
	Meloidae	Blister beetle
	Scarabaeidae	Green June beetle
Butterflies	Hesperiidae	Least skipper
		Silver-spotted skipper
		Skipper species
	Lycaenidae	Eastern tailed blue
	Nymphalidae	Red admiral
		American snout
		Pearl crescent
		Silvery checkerspot
		Hackberry emperor
		Variegated fritillary
		Common buckeye
		Monarch
	Papilionidae	Zebra swallowtail
		Spicebush swallowtail
		Pipevine swallowtail
		Black swallowtail
	Pieridae	Checkered white
		Orange sulphur
		Cabbage white
Flies	Unknown	Fly species #1
		Fly species #2
Moths	Erebidae	

Insect Pests

During surveys for rare flora by the VNHP in 2001, caterpillars of the tobacco budworm were found foraging on the federally threatened sensitive joint-vetch in the northern marshes of the refuge (Belden et al. 2002). Also, the gypsy moth, which can defoliate numerous species of trees, occurs in Chesterfield County and may occur at the refuge. However, complete stand defoliation occurs only in western Virginia, according to the Virginia Department of Forestry (email communication with Brian Lacey, November 2007).

The Asian longhorn beetle is believed to have been introduced into the U.S. from wood pallets and other wood packing material. It burrows into and kills maples, birch, elm, and other trees. Maples make up the largest percentage of the landscape trees in Virginia and it is very likely that it will arrive in the State at some point.

The most serious pest threatening Virginia's forests at this time is the emerald ash borer. The larvae of the beetles feed on the inner bark of ash trees and kill them. Emerald ash borer was discovered in northern Virginia in 2008. Green ash is a dominant tree species in the tidal swamp forest at Presquile NWR.

Southern pine beetle is another serious native insect pests in southern forests. The beetles lay eggs under the bark of pine trees. When the larvae hatch, they tunnel and feed just under the bark of the tree. This movement cuts off the flow of water up the tree causing the tree to die. The beetle population can increase dramatically during warm weather and quickly kill many acres of pines. Pine is not a dominant species at Presquile NWR and exists as scattered individuals, not in pure stands (VDOT 2010). The current low abundance of pine on the refuge should result in a low risk of a beetle infestation; however, as previously mentioned in other sections, changes in forest cover resulting from changes in management or global climate change may result in an increased abundance of pine.

Climate Change Impacts on Wildlife Resources

Climate change will have a range of effects on vegetation and ecological systems and the biological resources that depend on them. That landbirds are already exhibiting shifts in their winter centers of abundances or that some migrants are possibly returning earlier in the season has already been discussed. The possibilities for change in invertebrate fauna in response to climate change are poorly understood. This is particularly true for pollinators and their larvae, in the absence of a complete understanding in prospective changes in the species composition and distribution of their host plants. It is expected that species ranges will shift northward or toward higher elevations as temperatures rise, but responses will likely be highly variable depending on species or taxonomic group. Under these rapidly changing conditions, migration, not evolution, will determine which species are able to survive. Species that cannot migrate will suffer the most. For example, plants, mussels, amphibians—species that are vulnerable to temperature shifts—may be affected in their ability to survive, grow, and reproduce.

The Virginia Climate Change Strategy for Species of Greatest Conservation Need predicts that there will be significant challenges for species of greatest conservation need species. Over 60 percent of species of greatest conservation need are aquatic and another 15 to 20 percent rely on riparian and wetland habitats. Sediment load and increased turbidity in the James River, as well as increased inputs of herbicides, fungicides, and insecticides are anticipated (VDGIF et al. 2009). Since Presquile NWR is an island, the buffering effect against climate change provided by contiguous connection with adjacent habitat is not available to non-mobile species.

Four types of responses by animal and plant species are possible. First, the density of species may change locally and their ranges may shift in response to the need to find areas within their range of tolerance. Second, there will likely be changes in phenology, or the timing of such important life history events as flowering, egg-laying, and migration. Third, changes in body sizes and behaviors may occur. And fourthly, genetic frequencies may shift. In a study that investigated 61 studies on phenology changes of 694 species over the past 50 years, a statistically significant shift toward earlier timing of spring events was evident. An example species is the North American common murre, which has been breeding 24 days earlier per decade (Root et al. 2003) or the prothonotary warbler, which has been returning earlier. Data collected over the last 21 years of VCU study indicate that male prothonotary warblers are arriving to the refuge earlier in the breeding season (an average of 1 day per year) and the earlier arrival dates are correlated with a rise in average atmospheric temperature on the breeding grounds. Earlier arrival dates may be associated with occupation of better territories and a higher probability of breeding with multiple females (Blem et al. 2007).

Species with short generation times, such as insects and annual plants, might be helped in adapting to change because of their more rapid evolution. Longer-lived species such as trees, would experience longer evolution timeframes and thus be less adaptable (Rogers and McCarty no date specified). Since so many animal species time important events in their life cycles, particularly reproduction, so that young are produced when food sources are available, changes in other phonological events such as flowering or insect hatching, could be disastrous for species that fail to adapt in time. At this writing, it cannot be predicted how this will play out at Presquile NWR, but management should seek to provide biologically diverse habitats and connected corridors to provide a diverse species pool that can utilize the refuge habitat and increase the refuge's resilience to climate change.

Special Status Wildlife Species Surveys and Potential for Detection at Presquile NWR

In 2001, the VNHP conducted a zoological inventory at the refuge for targeted rare species. Targeted species for the zoological inventory included barking treefrog, yellow lampmussel, Ohio shrimp, rare skipper, glossy crayfish snake, and tidewater interstitial amphipod, and various insects of varying conservation ranks (see Belden et al. 2002 for complete lists). During surveys, two rare odonata formerly listed on the VNHP Heritage Watch list were collected. The blue dragonlet was collected in a ponded section of a small tributary to Flowerdew Hundred Creek, near the James River NWR. The big bluet damselfly was found to be common and was collected along the vegetated banks of Powell Creek at the James River NWR (Belden et al. 2002). These locations are close to Presquile NWR.

Two of the rare species above are known for Chesterfield County: barking treefrog and yellow lampmussel.

The barking treefrog is globally secure, is critically imperiled in Virginia, and is State threatened and is listed as being of very high conservation need (tier II) in the State's Wildlife Action Plan. This species inhabits sandy areas near shallow ponds in pine savannas and low wet woods or swamps (Martof et al. 1980). Although such habitat exists within the refuge, the refuge occurs along the extreme northern edge of the species' range, and consequently its possible presence is limited.

The yellow lampmussel is globally secure to very rare, is imperiled in Virginia, and is also a State special concern species. It inhabits shifting sands downstream from large boulders in relatively fast flowing, medium-sized rivers and medium

to large creeks and suitable habitat appears to be present within and adjacent to the refuge. Although recorded in Chesterfield County (NatureServe April 2010), it is also noted as extirpated or possibly extirpated.

The Rafinesque eastern big eared bat is a species of critical conservation need (State endangered; tier I) in the Virginia Wildlife Action Plan for the coastal plain. It is globally vulnerable to secure and State rare, as it has never been an abundant species. It is documented in nearby counties (Sussex and James City) with the core of the Virginia population occurring closer to the North Carolina border. It prefers forested wetlands and its main foods are moths. Essential habitat for roosting is hollow trees in wooded areas and mature hardwood floodplain forests, which the refuge does supply in modest quantity. More information is needed on the bat community of the Presquile NWR (<http://www.natureserve.org>; accessed April 2010) (VDGIF 2005).

Spotted turtle and eastern box turtle are listed as species of high conservation need (tier III) in the Virginia Wildlife Action Plan (high conservation need, extinction or extirpation possible). These two species are locally common in this part of Virginia but have not been documented on the refuge. The eastern box turtle, an upland forest species, faces considerable habitat fragmentation throughout its range.

The peregrine falcon, delisted from federally endangered status in 1999, is globally secure, critically imperiled as a breeding species and very rare/imperiled as a migrant in Virginia, and is State threatened. This predatory bird nests on cliff faces and tall buildings, and such breeding habitat does not occur within the refuge, although they have occasionally nested under bridges crossing tidal rivers. Foraging habitat is available around Presquile NWR.

The loggerhead shrike is globally secure, is uncommon to very rare as a breeding bird and uncommon to rare as a migrant in Virginia, and is State threatened. The species is a very rare permanent resident at the western edge of the coastal plain and even rarer further east. Two individuals were recorded during the 1997 and 1998 Christmas Bird Counts. Formerly a widespread breeder, breeding has been confined to one to two pairs at Fort Lee in Prince George county, where nesting was confirmed in 1997 and 1998 (Rottenborn and Brinkley 2007). This predatory songbird inhabits open grasslands with scattered trees, especially those bearing thorns, or meadows surrounded by barbed-wire fencing to cache their prey. The grasslands on Presquile NWR and surrounding landscape currently provide suitable habitat.

3.12 Cultural Resources

A comprehensive evaluation of the cultural and historic resources of the refuge, and an assessment of the overall archaeological sensitivity of the refuge lands, concluded that Presquile NWR has a high potential for preserved significant archaeological resources that could advance our understanding of Virginia's

human history (Goode et al. 2009). These resources include site components associated with American Indian settlement and subsistence, initial settlement of the James River by Europeans, Plantation society, military history, and post-Civil War rural agriculture. Six known archeological sites, the location of a farmstead complex dating from the 17th through 20th centuries with archaeological potential, and a large area with high probability of use by American Indians have been identified within the refuge.

The National Historic Preservation Act (Sec. 106) requires us to consider the potential effects of proposed actions on sites that are included in (or are eligible for inclusion in) the National Register. We also consider potential impacts to sites that probably exist, but have not yet been recorded.



Meghan Carfoll/USFWS

Bunkhouse construction site

3.12.1 Archaeological Resources and Collections

The diversity of archaeological evidence at Presquile NWR contributes to further understanding of Virginia's human history. Although no large archaeological investigations have been undertaken within the Presquile NWR, six small archaeological sites have been investigated. Five of these six sites were identified or investigated by Edward F. Heite, during his 1967 study of Bermuda Hundred (Goode et al. 2009). Most recently, the Service conducted an archaeological Phase I locational survey at the site of the proposed bunkhouse (Binzen et al. 2011). This survey discovered a previously unrecorded portion of an already documented archaeological site (Site 44CF120). The Service and Virginia Department of Historic Resources curate the refuge's cultural resource artifacts and document collections.

3.12.2 National Register Eligible Properties

The National Register is composed of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture. The National Register defines an archaeological site as "the place or places where the remnants of a past culture survive in a physical context that allows for the interpretation of these remains" (Little et al. 2000). Such properties may meet criteria for inclusion in the National Register for a variety of reasons, not the least of which may be because "they have yielded, or may be likely to yield, information important to prehistory or history" (National Register Criteria for Evaluation, 36 CFR 60.4). Below we describe two historic sites of concern on the refuge that may be affected by our proposed actions:

- (1) *Multiple Property Listing, "Prehistoric through Historic Archaeological Resources and Architectural Resources at Bermuda Hundred."* In 2006, Presquile NWR was placed on the National Register as part of a multiple property listing: Prehistoric through Historic Archaeological Resources and Architectural Resources at Bermuda Hundred (VDHR file #020-5370).
- (2) *Archaeological Site 44CF120, "Presquile House Archaeological Site and Cemetery."* Although the overall boundaries of the archaeological site are not known, the site is believed to be very large and complex. It includes the location of a former 17th to 19th century plantation and a 20th century farm complex. The site contains a remnant of a terraced orchard or garden situated northeast of the location of the former house. One of these terraces is also the location of the cemetery which contains four headstones, three of them inscribed with dates from 1797 to 1858. The remains of the Presquile House Site and Cemetery have a historic structure designation (although none of the historic buildings remain). This site is potentially eligible for listing on the National Register.

The recent Phase I archaeological survey at the proposed bunkhouse construction site discovered a previously unrecorded portion of Site 44CF120. The bunkhouse construction would occur within the former orchard portion of this property (Binzen personal communications 2012). The Service's Regional Historic Preservation Officer (RHPO) and the SHPO concurred that the proposed construction of the bunkhouse would have no adverse effect on this potentially eligible National Register property (USFWS 2011).

It is likely that many additional, unrecorded archaeological sites exist at Presquile NWR, awaiting identification. When an action is proposed in an area of archaeological sensitivity, it may be necessary to perform an archaeological investigation to locate any archaeological sites that may be present, and to evaluate their eligibility for the National Register.

3.12.3 Indigenous Cultural Landscapes

Indigenous Cultural Landscape

Presquile NWR is a good example of a new concept of place known as an "indigenous cultural landscape" (Beacham personal communication 2011). Developed during planning for the Captain John Smith Chesapeake NHT,

the concept is intended to represent large landscapes from the perspective of American Indian nations at the time of their first contact with Europeans. The indigenous cultural landscapes identified in the Chesapeake Bay area still have many of the cultural and natural resources that would have supported the historic lifestyles and settlement patterns of American Indian peoples in their totality. The concept also attempts to demonstrate that American Indian places were not confined to the sites of houses, towns, or settlements. It emphasizes that the American Indian view of one's homeland is holistic rather than compartmentalized into the discrete site elements typically described by European-descended peoples as "hunting grounds," "villages," or "sacred sites." More on this concept is described in appendix Q of the final Comprehensive Management Plan/EA for the Captain John Smith Chesapeake NHT (<http://parkplanning.nps.gov/CAJO>; accessed April 2012).

The conclusion that Presquile NWR exemplifies an indigenous cultural landscape is supported by the presence of several pre-contact archaeological sites, documentation by John Smith during the early 1600s about the Appamattuck territory, and persistence of landscape elements that supported American Indian communities. The good agricultural soil, sources of fresh water, transportation routes on the river, accessible landing places, marshes, brushy areas, and mixed deciduous forest were all central elements that supported American Indian communities for centuries prior to and following European settlement. Interpretation of the refuge as an indigenous cultural landscape is wholly consistent with the Service mission "to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people," which includes Native Indian peoples independent of Federal or State recognition.



Cyrus Brame/USFWS

Indigenous cultural landscape of Little Creek

European Settlement and Plantation Landscape

Topographic features associated with the plantation society and dairy farming are evident today at Presquile NWR. The pastoral scene in the refuge's uplands includes a few tall trees and farmstead buildings surrounded by mown lawn. The surroundings offer expansive and unobstructed views of the grasslands, bounded by tall swamp forest trees in the distance to the north and east; riparian buffer planting that stabilize the shoreline and obscure views of industrial buildings in Hopewell, Virginia to the south; the crest of a forested slope to the west; and

open sky. The scenery creates a feeling of having traveled back in time, while a few reminders of modern times keep the visitor grounded in the present. Modern elements of the scenery include the Menenak Discovery Center with a solar panel array and bunkhouse; occasional commercial aircraft flying overhead; and the sights, noises, and odors associated with nearby industrial plants which are occasionally noticeable from certain locations on the refuge.

Landscapes Evocative of the 17th Century

Presquile NWR's indigenous cultural landscape combines with the European settlement and plantation landscape to be evocative of the 17th century. Together, the feeling of the world Captain John Smith encountered as he explored the Chesapeake and Europeans began establishing settlements exists where modern intrusions of sight, sound, and odors are largely absent. Such places are increasingly rare and offer limited opportunities for public access.

With assistance from the Tribal organizations, NPS, and JRA, we have begun weaving cultural resources and history into our refuge's natural resource stories through our educational and interpretive communications. We aim to promote a deeper understanding of America's diverse peoples and to inspire refuge stewardship by telling a more complete story of the area's significance in the past, present, and future.

3.13 Public Uses

This section describes the public access, education, and recreation opportunities at Presquile NWR. Recreation features and access points on the refuge are available from the refuge Web site (<http://www.fws.gov/northeast/Presquile>; accessed September 2012). The most recent public use management plan for Presquile NWR was prepared by the Service in 1994.

During the 1980s, three full-time employees and one part-time employee administered activities and facilitated visits by ferrying approximately 2,600 people to the refuge annually. In recent years, only one full-time employee has been administering activities and facilitating visits to Presquile NWR, as well as at James River NWR and Plum Tree Island NWR. In 2001, the U.S. Coast Guard deemed the ferry unsafe for continued transportation of the public to Presquile NWR. Refuge visitation has declined to approximately 400 people annually due to reductions in refuge staff, budget, and transportation capabilities.

Six priority public uses were identified by the Refuge Administration Act: wildlife observation, photography, environmental education, interpretation, hunting, and fishing. In accordance with the Refuge Administration Act and Service policy, these uses receive enhanced consideration over general public uses in the Refuge System.

3.13.1 Wildlife Observation, Photography, Environmental Education, and Interpretation

The refuge opened to organized groups (e.g., school, civic, and church groups) for walking the nature trail, wildlife observation, and photography in 1973 (38 FR 13563; codified in 50 CFR 28.28). Since its opening, these public uses have been found to be appropriate and compatible. We recently updated the compatibility determination for these uses. The compatibility determination includes stipulations to ensure compatibility, including the requirement to coordinate and schedule visits with refuge staff. The approved compatibility determination is included in appendix B of this CCP.

Between 1977 and 1988, an average of 2,068 visitors participated in these uses annually. Decommissioning of the ferry for visitor transport combined with the reallocation of refuge budget, staff, and priorities resulted in a substantial drop in refuge visitation. Between 2007 and 2011, an average of only 307 visitors

participated in these uses annually. In recent years, we have received fewer than 30 annual requests from individuals or small groups to visit the refuge. We offer up to six pontoon trips to and around the refuge annually; up to 96 individuals participate in these trips. Approximately 300 additional visitor contacts are made when we participate in off-refuge community and civic events, as well as on-refuge volunteer events. Each of the events and programs on-refuge fills quickly.

In an attempt to reverse the declining refuge visitation, we have been collaborating with JRA for the past 5 years. Together, we are able to offer high-quality environmental education programs at Presquile NWR. Since 2007, the JRA has led environmental education programs for approximately 120 school-aged students each year. A Visitor Services Review for Presquile NWR (USFWS 2010b) recommended that we proceed to expand opportunities for wildlife observation, photography, environmental education, and interpretation through our partnership with the JRA.

No formal visitor satisfaction surveys have been conducted for these uses at Presquile NWR. However, some visitors voluntarily provide feedback, which the refuge uses to improve communications and update programming. The majority of visitors have expressed to us that their visit was very enjoyable and satisfying because they had the opportunity to immerse themselves in a natural setting, with few to no encounters with other people.

The JRA Partnership for the Ecology School at Presquile NWR

The JRA is the oldest and largest river conservation group in Virginia and is the only nonprofit organization solely dedicated to protecting and restoring the James River. The mission of the JRA is to be the guardian of the James River by promoting conservation and responsible stewardship of its natural resources.

In 2006, we began working with the JRA to create the Ecology School, a residential environmental education program on the refuge. The Ecology School offers students a welcoming, safe, and accessible environmental education program that incorporates a variety of hands-on opportunities to enjoy, learn about, appreciate, and participate in efforts to conserve America's wildlife, with a special emphasis on the Chesapeake Bay and the James River watershed. Facilities that support operation of the Ecology School at Presquile NWR include the environmental education center, bunkhouse (construction initiated in summer 2012), tidal swamp forest boardwalk, trail network, observation platform, and boat docks.

In 2007, we signed an MOU with the JRA detailing our mutual conservation goals and environmental education objectives. Our partnership with JRA to establish the Ecology School exemplifies the Service's commitment to fulfilling the goals of President Obama's *America's Great Outdoors Initiative*, Executive Order 13508: *Chesapeake Bay Protection and Restoration*, and the Refuge System's renewed vision, detailed in *Conserving the Future: Wildlife Refuges and the Next Generation* (USFWS 2011).

The MOU recognizes that Presquile NWR provides an outstanding opportunity to promote an appreciation and understanding of fish and wildlife ecology, and the human role in the environment, through environmental education programming. Our strategic partnership with the JRA brings financial and human resources together to work more efficiently and effectively toward achieving our mutual conservation and stewardship goals. In the absence of this partnership, it is unlikely that the Service would solely be able to financially support and administer the Ecology School at Presquile NWR.

The MOU states that the Service and JRA will determine, on an annual basis, mutually acceptable educational, habitat improvement, or wildlife-oriented projects that JRA will accomplish as part of its environmental education mission for the benefit of the refuge. The MOU does not specify the number or quality of educational opportunities on the refuge, and it does not specify the number of students to be served by the Ecology School.

3.13.2 Public Deer Hunting

The refuge opened to public deer hunting in 1967 (32 FR 12444; codified in 50 CFR 32.31). Proposed changes to the refuge-specific regulation revisions have been published in the *Federal Register* and Title 50 in the CFRs annually since that time. We prepared a compatibility determination and categorical exclusion in 1994 (USFWS 1994). An updated compatibility determination is included in appendix B of this document. The Service has planned an updated NEPA review of the refuge's public deer hunt.

Public deer hunting at Presquile NWR is used as a means to manage the population and as a recreational use of the refuge. Between 1977 and 1988, an average of 199 visitors participated in the annual public deer hunt. Decommissioning of the ferry for visitor transport combined with the reallocation of refuge budget, staff, and priorities resulted in a substantial drop in refuge visitation. Between 2007 and 2011, an average of only 92 visitors participated in the annual public deer hunt. However, as a result, hunters' success rates have improved and administrative costs have been dramatically reduced.

A 3-day shotgun deer hunt in the fall is conducted on the refuge in accordance with State regulations. A maximum of 120 hunters (40 hunters per day) may participate in the quota hunt, which is administered in partnership with the VDGIF. Each hunting permit applicant is charged a processing fee. Hunters may take two deer, of either sex, per hunt day; a maximum of 240 deer may be harvested from the refuge annually.

The refuge does not operate a check station, but hunters are required to report their harvest in accordance with State regulations. The hunt is generally not filled to capacity (up to 40 hunters per day) because hunters may not meet the permit payment requirement, may not submit permit documents with all necessary signatures, and may choose not to participate in the hunt days due to inclement weather. We estimate that approximately 30 to 35 hunters participate in the hunt on good weather days (Brame personal communication).

Voluntarily provided feedback from hunters is used by refuge staff to improve hunting-related communications in the upcoming year. Following the hunt, some hunters contact refuge staff to talk about their hunt experience and to share photographs. Feedback provided is positive, with hunters mentioning how appreciative they are for the opportunity to hunt in this remote setting, expressing their excitement about having won the lottery to go hunting on the refuge, and that the hunt experience itself was unique. Hunters give positive feedback independent of their hunt success. We estimate that 10 to 20 percent of the hunters successfully harvest a deer (Brame personal communication).

The most recent health assessment of the local deer population was conducted in 2004, and study results indicate that the deer population in the vicinity is higher than optimal for Presquile NWR (Moyer 2004). We did temporarily operate a deer check station on the refuge during the 2005 and 2006 hunt, and the data collected indicated that the deer population seemed to be healthy (VDGIF 2005).

3.13.3 Fishing

The James River is Virginia's premier trophy blue cat fishery due to having large quantities of fish 50 pounds and larger (VDGIF 2011). However, Presquile NWR has not been opened to fishing from refuge property since refuge establishment (USFWS 1994) to protect sensitive shoreline habitat, minimize disturbance to wildlife, and because ample fishing opportunities exist on nearby waters allowed by State regulation and on adjacent lands where permitted by the land owner. We have not received any requests to open the refuge to fishing from the refuge shoreline, facilities, or structures in the past 9 years since current staff have been in place (Brame personal communication).

3.13.4 General Public Uses

In addition to the priority public uses described above, we have evaluated other general uses for their appropriateness and compatibility. Appendix B includes our updated evaluations and decisions.

The following activities were found to be appropriate and compatible:

- Research (general and targeted species surveys for plants and animals; bird banding; and health assessments of reptiles, birds, and deer)
- Wildlife observation and photography
- Environmental education
- Interpretation
- Hunting

The following activities were determined to be not appropriate uses of the refuge:

- Picnicking
- Cross-country skiing, snowshoeing, and sightseeing
- Collecting natural products
- Dog walking
- Geocaching
- Swimming and sunbathing

These activities were previously evaluated in 2007 and determined to be not appropriate. Appendix B includes updated findings in accordance with Service policy (603 FW 1).